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<tbody>
<tr>
<td>AFY</td>
<td>acre-feet per year</td>
</tr>
<tr>
<td>ARPA</td>
<td>American Rescue Plan Act</td>
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<tr>
<td>ASO</td>
<td>Airborne Snow Observatory</td>
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<tr>
<td>ASR</td>
<td>aquifer storage and recovery</td>
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<tr>
<td>ATM</td>
<td>Alternative Transfer Methods</td>
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<tr>
<td>BIP</td>
<td>Basin Implementation Plan</td>
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<tr>
<td>BLM</td>
<td>U.S. Bureau of Land Management</td>
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<tr>
<td>BOR</td>
<td>Bureau of Reclamation</td>
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<tr>
<td>BRAT</td>
<td>Beaver Restoration Assessment Tool</td>
</tr>
<tr>
<td>CASM</td>
<td>Colorado Airborne Snow Measurement</td>
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<tr>
<td>CBT</td>
<td>Colorado-Big Thompson</td>
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<tr>
<td>CDAA</td>
<td>Colorado Department of Agriculture</td>
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<tr>
<td>CDPHE</td>
<td>Colorado Department of Public Health and Environment</td>
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<tr>
<td>CDSS</td>
<td>Colorado’s Decision Support Systems</td>
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<tr>
<td>cfs</td>
<td>cubic feet per second</td>
</tr>
<tr>
<td>CGWS</td>
<td>Colorado Growing Water Smart</td>
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<tr>
<td>CoRHAF</td>
<td>Colorado River Health Assessment Framework</td>
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<tr>
<td>COSWAP</td>
<td>Colorado Strategic Wildlife Action Program</td>
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<td>Colorado Parks and Wildlife</td>
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<td>CREP</td>
<td>Conservation Reserve Enhancement Program</td>
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<tr>
<td>CRO</td>
<td>Colorado Resiliency Office</td>
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<td>CROS</td>
<td>Coordinated Reservoir Operations</td>
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<td>CRSPA</td>
<td>Colorado River Storage Project Act</td>
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<td>CSFS</td>
<td>Colorado State Forest Service</td>
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<td>Colorado State University</td>
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<tr>
<td>CWA</td>
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<td>CWCB</td>
<td>Colorado Water Conservation Board</td>
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<tr>
<td>CWLI</td>
<td>Colorado Water Loss Initiative</td>
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<td>CWRPDA</td>
<td>Colorado Water Resources and Power Development Authority</td>
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<tr>
<td>CWSA</td>
<td>collaborative water sharing agreements</td>
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<tr>
<td>DCP</td>
<td>Drought Contingency Plan</td>
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<tr>
<td>DFPC</td>
<td>Division of Fire Prevention and Control</td>
</tr>
<tr>
<td>DHSEM</td>
<td>Division of Homeland Security &amp; Emergency Management</td>
</tr>
<tr>
<td>DI</td>
<td>disproportionately impacted</td>
</tr>
<tr>
<td>DM</td>
<td>Demand Management</td>
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<td>Department of Natural Resources</td>
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<tr>
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<td>Department of Local Affairs</td>
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<td>DPR</td>
<td>direct potable reuse</td>
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<tr>
<td>DRCOG</td>
<td>Denver Regional Council of Governments</td>
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<tr>
<td>DROA</td>
<td>Drought Response Operations Agreement</td>
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<td>Division of Water Resources</td>
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<tr>
<td>EDI</td>
<td>equity, diversity, and inclusion</td>
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<tr>
<td>EJ</td>
<td>environmental justice</td>
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<td>EPA</td>
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<td>Future Avoided Cost Explorer</td>
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<td>Federal Energy Regulatory Commission</td>
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<tr>
<td>FHZ</td>
<td>Fluvial Hazard Zone</td>
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<tr>
<td>GIS</td>
<td>geographic information systems</td>
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<td>GOICO</td>
<td>Great Outdoors Colorado</td>
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<tr>
<td>gpcd</td>
<td>gallons per capita per day</td>
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<tr>
<td>HB</td>
<td>House Bill</td>
</tr>
<tr>
<td>HUC</td>
<td>Hydraulic Unit Code</td>
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<tr>
<td>IBCC</td>
<td>Interbasin Compact Committee</td>
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<tr>
<td>IIJA</td>
<td>Infrastructure Investment and Jobs Act</td>
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<tr>
<td>IPR</td>
<td>indirect potable reuse</td>
</tr>
<tr>
<td>ISF</td>
<td>Instream Flow</td>
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<tr>
<td>IWMP</td>
<td>integrated water management plan</td>
</tr>
<tr>
<td>LiDAR</td>
<td>light detection and ranging</td>
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<tr>
<td>N/A</td>
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<tr>
<td>NEPA</td>
<td>National Environmental Policy Act</td>
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<tr>
<td>NGO</td>
<td>nongovernmental organization</td>
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<tr>
<td>NLL</td>
<td>natural lake level</td>
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<tr>
<td>NPS</td>
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<td>Natural Resources Conservation Service</td>
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<td>OEDIT</td>
<td>Colorado Office of Economic Development and International Trade</td>
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<td>PEPO</td>
<td>Public Education Participation and Outreach</td>
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<td>PRRIP</td>
<td>Platte River Recovery Implementation Program</td>
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<td>RGDSS</td>
<td>Rio Grande Decision Support System</td>
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<td>RICD</td>
<td>recreational in-channel diversion water right</td>
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<tr>
<td>SB</td>
<td>Senate Bill</td>
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• Cover  Birds take flight over the Yampa River near Steamboat Springs on the Daughenbaugh Ranch, Photo credit: M. Nager; Small Town and Suburban Sprawl in Colorado*, Father and son fish by lake, dad looks at camera*; Aerial of green pastures and river, Photo credit: Kent Vertrees, Friends of the Yampa
• Page 5  A Woodhouse’s Scrub-jay enjoys a Colorado winter morning*, Hiker standing in front of Snowmass Mountain at sunset*
• Page 1  Rafters, cactus flowers, Photo credit: Kent Vertrees, Friends of the Yampa
• Page 2  A trip up the Animas River*
• Page 3  Fly fishing at Dream Lake in Rocky Mountain National Park, Colorado*
• Page 7  Opening ceremony of Southern Ute Indian Tribe Pow Wow in Ignacio Colorado Fairgrounds*
• Page 11  Professional skier at sunset on relax moment at ski resort*
• Page 13  Apples in crates at Gunnison Grand Mesa, Photo Credit: Gunnison Basin Roundtable; Medano Creek at Great San Dunes National Park, Photo credit: Heather Dutton
• Page 14  The Colorado River Flows Under a Sunset in the Glenwood Canyon in Glenwood Springs*
• Page 17  Monument Creek running through Colorado Springs*
• Page 19  Crowd of people walking down a busy street sidewalk in downtown city*
• Page 20  Drought dry dirt*
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• Page 25  A summer sunset mixed with storm clouds along the Park Range in North Park’s Walden, Colorado; A beautiful lake park in Cortez, Colorado*
• Page 26  Winter sunset over river in Colorado*
• Page 40  Stone stairs along mountain river on tourist route*
• Page 42  Fall Foliage San Juan Mountains*

* Shutterstock Stock Image | ** Adobe Stock Image
Fellow Coloradan,

Thank you for opening the Colorado Water Plan. With this document, the Board and Staff of the Colorado Water Conservation Board (CWCB) seek to respond to this historic moment in time with a plan for thoughtful and bold initiative.

Much has changed since 2015, when the first Colorado Water Plan was finalized. The impacts of widespread drought, coupled with a global pandemic, challenged our communities with far-reaching uncertainties that shaped new water management realities. The pandemic pushed our stakeholders to begin meeting virtually, bringing a new way for people to connect, learn, and get involved with the work of planning for water. These experiences also highlighted the ways in which Colorado is connected by water.

Towns and farms on the Front Range are tied to high mountain streams on the West Slope through the complicated plumbing that brings water through the Continental Divide. Beyond these physical connections, there is a shared understanding that water supports Colorado’s culture, communities, recreation, forests, and foods. The fresh produce, meat, and beer enjoyed in restaurants and kitchens around our state are supplied by farming and ranching families with diverse backgrounds and often multi-generational and historical ties to the land they steward. Coloradans value healthy rivers that drive robust recreation economies and provide important corridors for fish and wildlife, quality drinking water for cities and towns, and spaces for people to connect with nature. Colorado is the state we know and love because of its lakes, rivers, streams, wetlands, and aquifers. Because water inextricably links people across Colorado, our water management challenges must be faced together.

GET INVOLVED—NOW IS THE TIME FOR ACTION

The West is experiencing growth in population and demand for water while our hydrology is becoming less predictable. Our temperatures have warmed, and the timing and amount of precipitation has changed, causing shifts in runoff and streamflows. It is clear this is not a temporary phenomenon, but rather a permanent trend toward aridification of the West. These changes, on top of existing concerns, present increased water quantity and water quality challenges especially as the rate and magnitude of ecosystem changes in Colorado have increased. These collective impacts have changed the way we think about water planning and shifted our collective approach to swift action.

The Colorado Water Plan was informed by robust stakeholder input and complex modeling that provides a data-driven understanding of our current water supply and potential future scenarios. The plan also highlights Colorado’s values and follows four fundamental themes of Thriving Watersheds, Resilient Planning, Vibrant Communities, and Robust Agriculture through discussions of each of our major river basins. Most importantly, the plan sets forth ambitious yet attainable actions that will help Coloradans do more with less water, increase resiliency in the face of a changing climate, and ensure broad and diverse voices are included in future water management conversations.
The CWCB cannot do this important work alone, which is why the partner
actions take into account close working relationships with sister agencies and the critical efforts of partner organizations, water users, and water managers across the state. This will require thoughtful and strategic partnerships across state agencies, Tribal Nations, local governments, water providers, and stakeholders. Colorado needs collaborative and creative solutions for balancing competing water demands for a finite resource.

Whether by personal action or developing a Water Plan grant project, you have a role to play.

The CWCB will also continue to lead through funding, collaboration, and the agency actions it will take. Importantly, the plan outlines a 10-year schedule for future Water Plan updates and includes the addition of an annual operations plan, which will allow the CWCB Board to consider yearly priorities and respond to shifting conditions and needs. Addressing Colorado's water challenges through partnerships and collective action ensures that competing demands for water resources decisions are balanced and maximize the benefits to current and future generations. Colorado has always been a place where the adversity of the landscape has been tempered by its ability to inspire. While our challenges are great, our natural and human resources are too. We have a long and celebrated history of innovation in water management, and we are confident the people of Colorado will continue to rise to the occasion and take on the critical work of protecting our water supply future. The Colorado Water Plan offers a light through dark and uncertain times, bringing together wide-ranging interests and voices into a collective vision, and more importantly, a plan for action over the next ten years for both CWCB and local communities across the state.

The collective actions we take today across every corner of the state will increase water resilience for Colorado and our downstream neighbors. We hope you will consider your own role in Colorado’s water future and get involved—now is the time for action.

On behalf of the staff and the current and past board members of CWCB, thank you for reading the Colorado Water Plan.

—The Colorado Water Conservation Board
ACKNOWLEDGMENTS

**CWCB BOARD:**
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Vice Chair: Greg Felt
Other Directors:
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- Paul Bruchez
- Steve Anderson
- Jessica Brody
- Paul Bruchez
- Heather Disney Dugan
- Dan Gibbs
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**OTHER STATE AGENCIES**
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- Colorado Department of Agriculture
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- Department of Local Affairs
  - Morgan Ferris, Elizabeth Garner, Marguerite Harden, KC McFerson, Anne Miller, Desiree Santerre
- Colorado Outdoor Recreation Industry Office
  - Conor Hall
- Colorado Oil and Gas Conservation Commission
  - John Messner
- Division of Water Resources
  - John Hunyadi, Tracy Kosloff, Mike Sullivan
- Colorado Parks and Wildlife
  - Karlyn Armstrong, Reid Dewalt, Rob Harris, Matt Nicholl, Ed Perkins
- Colorado Attorney General’s Office
  - Emily Halvorsen, Lain Leoniak, Jen Mele

**COLORADO STATE LEGISLATIVE BRANCH**
- 2022 Water Resources and Agriculture Review Committee

**COLORADO STATE EXECUTIVE BRANCH**
- Governor and Lt. Governor’s Office
- Governor Jared Polis and Lt. Governor Dianne Primavera
- Other Support Governor and Lt. Governor Support Staff
- Jonathan Asher, Kathryn Redhorse
- Department of Natural Resources Executive Director’s Office
- Chris Arend, Angela Boag, Carly Jacobs, Tim Mauck, Vanessa Mezal, Nate Pearson, Kelly Romero-Heaney
OTHER STATE ENTITIES, GROUPS, ORGANIZATIONS, AND TASK FORCES WHO PROVIDED WATER PLAN INPUT:


COLORADO’S FEDERALLY RECOGNIZED TRIBES

Southern Ute Indian Tribe, Ute Mountain Ute Indian Tribe

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WILSON WATER GROUP

- Lead: Kara Sobieski
- Brenna Mefford, Lisa Wade, and Erin Wilson

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TRANSLATION SERVICES & OUTREACH

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- Community Language Cooperative
- Affinity Translation

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- Strategic By Nature - Stacy Beaugh
- Connected Realities - GeGe Howard; Joy Lujan

CWCB would also like to recognize all the individuals and organizations who were kind enough to support CWCB staff with more than 100 events, with at least one in each of the state’s 64 counties. We are grateful for your time, for sharing booth space, for providing tours, and for your partnership.

Special thanks to all those collaborating consultants who helped support the development of the Basin Implementation Plans that inform the Colorado Water Plan, including CBI, CDM Smith, Forsgren Associates, Harris Water Engineers, HDR, J-U-B Engineers, LRE Water, Rio Grande Headwaters Restoration Project, SGM, and Stantec.

Also, CWCB would like to express appreciation to those who provided input during outreach events, listening sessions, CWCB board meetings, and public comment on the Water Plan.

*Director participation noted through their role on the CWCB Board (See list above).*
CHAPTER 1

OVERVIEW
THE 21ST CENTURY IS THE ERA OF LIMITS MADE APPLICABLE TO WATER DECISION MAKING. DUE TO NATURAL WESTERN WATER SCARCITY, WE ARE NO LONGER DEVELOPING A RESOURCE. INSTEAD, WE ARE LEARNING HOW TO SHARE A DEVELOPED RESOURCE.

— GREGORY J. HOBBs
Former Colorado Supreme Court Justice
Chapter 1: Overview

Colorado's water touches every aspect of our daily lives. Those that depend on the water face unprecedented challenges that require all Coloradans to embrace a new water ethic. We must come together to protect this critical resource in increasingly innovative ways. The time for action is now.

As a headwaters state, water flows from Colorado's snow-capped peaks, through forests and streams, to cities and farms, and then returns to streams. Along the way, water supports habitat, wildlife, recreation, local food production, energy, industry, drinking water supplies, and more. Water connects us all. The importance of water is long recognized by the ancestral and Indigenous peoples of Colorado — the 48 Tribes that historically were the original stewards of this land include Colorado's two federally-recognized Tribes, the Southern Ute Indian Tribe and the Ute Mountain Ute Indian Tribe. As noted by the Tribes, “Water is life.”

Nearly 6 million Coloradans depend on the water from our major river basins as do 19 other states and Mexico, but that water supply is at risk. Population growth, long-term warming trends, major wildfires, aridification, and multi-year droughts are straining the system like never before.

We must understand these challenges, their associated risks, and the tools we can use to drive change. Tools that shape actions and policy to mitigate our risks can reshape the future. We must also be collaborative and understand the perspectives of water users from across the state. Basin Implementation Plans, developed by Colorado's nine basin roundtables, provide summaries of regional challenges, strategies to overcome them, and valuable data to inform the state's Water Plan.

The Colorado Water Plan sets the stage for a shared understanding of our risks and describes actions that collectively contribute to a stronger, more water-resilient Colorado.

Collaborative action needs to occur at every level, and the need for action has never been more urgent than now.
The devastation of the 2002 drought and Hayman Fire launched a new era of resiliency planning and collaboration in Colorado that led to the creation of many of the state's grassroots water stakeholder groups, the Colorado Water Plan (Water Plan), and a continued investment in water. These efforts have made real progress since the 2015 Water Plan to better manage and fund Colorado's water, as noted below:

- Water conservation measures have decreased statewide per capita water use by 5%.
- Colorado Water Plan grants were established and funded almost $55 million in projects covering every corner of the state.
- More than 25 new stream management plans have been developed.
- Annual municipal leasing of 25,000 acre-feet of agricultural water has helped cities and farms coexist.
- More than 25 new stream management plans have been developed.
- 400,000 acre-feet of storage has either been constructed or will soon be completed.
- Water outreach, education, and messaging is estimated to have reached up to 2.7 million people.
- Legislation was passed to integrate land use and water planning in comprehensive plans.
- Reclaimed water regulations have been updated with 18 additional uses to allow water reclamation in residential and commercial crop irrigation, among others. See Chapter 5 for more information on reclaimed water regulations.
- 62% of Coloradans now live in communities whose leaders have been trained by the Growing Water Smart program to integrate water and land use planning.
- Multi-purpose, multi-benefit projects continue to receive grant funding and more than $420 million in loans.
- Watershed health received millions of dollars in support as statewide watershed groups exceed 150.
- Colorado voters passed Proposition DD to dedicate funding for the Colorado Water Plan Grant Program.

These successes should be celebrated because they show significant progress, firm resolve, and a blueprint for collaborative action. Yet, the need for progress is now more urgent than ever. In the last two decades Colorado's population has increased by more than a million people. Several major wildfires have ignited our forests and grasslands, and drought, along with a larger trend in long-term warming and drying, known as aridification, continues to challenge water resources. Significant swaths of agricultural lands have been lost to buy and dry practices, water supply reductions, and urbanization; forests face continued risk from fire; and streams face new challenges for habitat protection.

In the face of this adversity, there has been a groundswell of collaborative action leading to real progress through holistic and multi-benefit projects. It is increasingly important to make sure every water project or strategy uses water as wisely as possible, making it stretch as far as it can to realize its maximum value for cities, farms, streams, and people. Doing so will require shared stewardship—a commitment to partnership in which the state government and every Coloradan must work together toward greater action.

Colorado's nine basin roundtables have been instrumental in fostering our past successes and forming the future vision described in the Water Plan. Chapter 4 describes local challenges, recent achievements, and strategies to meet future needs that each basin roundtable provided in their Basin Implementation Plans - all of which inform the Water Plan.

1 Generalized findings from Alternative Transfer Methods in Colorado, Status Update, Framework for Continued Support, and Recommendations for CWCB Action
2 Includes Chimney Hollow Reservoir (90,000 acre-feet), Glade Reservoir (170,000 acre-feet), Galeton Reservoir (45,600 acre-feet), Gross Reservoir Expansion (77,000 acre-feet), and Chatfield Reallocation (20,600 acre-feet)
3 Proposition DD is a legislatively referred state statute on the November 2019 ballot that was ultimately codified in HB19-137 and provided funds from sports betting to be used, among other things, to fund the Water Plan through the creation of a Water Plan Implementation Cash Fund that is used to support CWCB's Colorado Water Plan Grant Program.
Chapter 1: Overview

As the stewards of the Water Plan and the agency charged to conserve, develop, protect, and manage Colorado's water for present and future generations, CWCB works with partners to foster action by funding local water projects through grants and loans. The CWCB also works on multiple programmatic efforts related to interstate compacts, flood mitigation, species protection, water project financing, agricultural support, and climate adaptation, all of which advance the goals of the Water Plan.

The CWCB does not build projects. It advances projects, often focusing on proven methods, by supporting project proponents with funding, analysis tools, technical assistance, programs, and policies that can help advance toward a future envisioned by the values and ideas in this Water Plan. The real power of the Water Plan is often driven by local and regional innovation, action, and project development that advance when stakeholders take action. This is readily apparent in the work that the state's nine legislatively-created basin roundtables completed to identify more than 1,800 local projects and plans in the lead-up to the Water Plan update (See Chapter 4).

The Water Plan was informed by and built through stakeholder input. Basin-specific technical analyses, local stakeholder input, and statewide outreach informed the Water Plan by explaining local conditions, offering examples of successful projects, and gathering information about future projects needed for increased water resilience. The process involved ongoing work with basin roundtables and the Interbasin Compact Committee (IBCC), engagement with more than 1,200 stakeholders providing feedback during Water Plan scoping, multiple partners (agencies, Tribes, nongovernmental organizations [NGO], and members of the public) as well as a governor-created Water Equity Task Force. Stakeholders were also engaged during public review of the draft Water Plan through outreach events in all 64 Colorado counties, more than 2,000 submitted public observations on the draft plan, and more than 500 pages of public comment letters. Approximately 130 public comments were submitted in Spanish. This spirit of collaboration and the focus on Colorado water resilience is at the heart of the Water Plan, and implementing the Water Plan is critical to Colorado's future.

Meeting the moment extends well beyond what one agency or the entirety of the state government can do. The power of nearly 6 million Coloradans rallying to embrace a new water ethic in Colorado is what we need to be successful. The Water Plan is a call to action backed by governmental support that can catalyze local planning and projects.

PUBLIC ENGAGEMENT AND WATER EQUITY TASK FORCE

Building on years of ongoing grassroots input, CWCB included a scoping phase early in the Water Plan update process to evaluate the critical issues on stakeholders' minds and provide a platform to discuss CWCB's proposed direction for the Water Plan. As part of that effort, CWCB partnered with 20 agencies and NGOs to hold more than a dozen sector-specific workshops that engaged more than 1,200 stakeholders. Targeted interviews, online surveys, and an online stakeholder engagement platform supplemented the scoping outreach. This work gathered extensive input on stakeholder issues related to agricultural, municipal, watershed, and forest health issues related to agricultural, municipal, watershed, and forest health.

This Water Plan included addressing climate change and drought as well as climate change and water issues. The Water Equity Task Force's guiding principles include a need to:

1. Promote diversity in career pathways and engagement.
2. Promote collaboration and greater community engagement in water discussions.
3. Recognize and address elements of the rural-urban divide and the rural-urban opportunity.
4. Expand grant opportunities to new audiences.
5. Support basin roundtables facilitating broad community engagement and collaborative solutions.
6. Use public engagement and water equity task force to inform programming, policies, and engagement.
Use the plan to **become more informed about water and the future vision**.

- Support local water initiatives and projects
- Conserve water indoors and outdoors
- Practice wise stewardship of our rivers, lands, and natural resources
- Purchase water-saving products and locally grown food products
- Help promote water conservation and water outreach efforts
- Support local utility/city/county water conservation, local food, and resilience

Use the plan as a platform to **become more engaged and take action to advance the vision**.

- Attend a local water meeting (e.g., basin roundtable)
- Join a water-focused stakeholder group (e.g., NGO or basin roundtable)
- Start a local food or watershed group
- Apply for a grant to take action on the Water Plan
- Invest in water-efficient equipment in your home, business, or farm
- Work with your local community leaders to advance water projects

**Opportunities to participate at this level include:**

- **Support local water initiatives and projects**
- **Conserve water indoors and outdoors**
- **Practice wise stewardship of our rivers, lands, and natural resources**
- **Purchase water-saving products and locally grown food products**
- **Help promote water conservation and water outreach efforts**
- **Support local utility/city/county water conservation, local food, and resilience**

**Opportunities to participate at this level include:**

- Attend a local water meeting (e.g., basin roundtable)
- Join a water-focused stakeholder group (e.g., NGO or basin roundtable)
- Start a local food or watershed group
- Apply for a grant to take action on the Water Plan
- Invest in water-efficient equipment in your home, business, or farm
- Work with your local community leaders to advance water projects
Use the plan to understand and leverage agency actions that advance the vision.

Opportunities to participate at this level include:

• Attend a state water meeting (e.g., CWCB board meeting, basin roundtable meeting, legislative hearing, or committee meeting)
• Apply to join a water-focused board or commission
• Learn about and use State tools that have been developed to support action
• Engage with the State to create new supporting tools and processes
• Implement a local project that aligns with the Water Plan and, if possible, use state and federal resources to help fund the project
• Coordinate with local leaders to advance water policy

EVERYONE NEEDS TO UNDERSTAND HOW VALUABLE WATER IS, NOT JUST TO NATIVE PEOPLE, BUT TO EVERY SINGLE ONE OF US... IT’S ALL OF US WORKING TOGETHER TO UNDERSTAND THAT WATER TRULY IS THE ESSENCE OF LIFE.

— LORELEI CLOUD from the Water Equity Task Force Public Workshop
The Water Plan is structured to create a line of sight from Colorado’s water values to the specific actions that address challenges. The four values in the Water Plan are based on extensive work with stakeholders and include:

- A productive economy that supports vibrant, sustainable cities, agriculture, recreation, and tourism
- An efficient and effective water infrastructure system
- A strong environment with healthy watersheds, rivers, streams, and wildlife
- An informed public with creative, forward-thinking solutions that are sustainable and resilient to changing conditions and result in strong, equitable communities that can adapt and thrive in the face of adversity

Most simply, these values represent the Colorado way of life—they are the things that make Colorado great. They are also the values that help inform the Water Plan organization and drive us to act. Taken as an acronym, our values drive us to A.C.T. through Action Areas, Colorado Vision, and Tools for Action.

**Action Areas**

VIBRANT COMMUNITIES: counties, municipalities, utilities, cities, towns, businesses, large industries, large and small urban and rural communities, etc.

ROBUST AGRICULTURE: established crops and farms, local food, orchards, ranching, ditch companies, acequias, urban agriculture, livestock, dairy, etc.

THRIVING WATERSHEDS: environment and recreation, river health, watershed health, forest health, wildfire mitigation, wildlife and aquatic species protection, etc.

RESILIENT PLANNING: climate adaptation, planning for climate extremes, embracing EDI (equity, diversity, inclusivity), education, outreach and engagement, supportive government, etc.

Sunset over Yampa River, Photo credit: Kent Vertrees, Friends of the Yampa
Chapter 1: Overview

Colorado Vision

The Colorado Vision, outlined in Chapter 6, describes how Colorado can achieve greater resilience across and within the four action areas as we look to the planning horizon of 2050. The vision for each action area first describes our desired future and then provides examples of the kinds of local actions stakeholders and partners can take to help realize the vision. Example actions are grouped into categories, including thoughtful storage, meeting future water needs, wise water use, healthy lands, and engaged partners. In addition, each action area vision describes ways in which it intersects and integrates with other action areas to demonstrate how the areas are intertwined and relate. The overarching vision for each action area is described below.

VIBRANT COMMUNITIES

Holistic water management is essential for creating vibrant communities that balance water supply and demand needs to create a sustainable urban landscape. Colorado communities need resilient water supplies, water-conscious and attractive urban landscapes, planning that integrates land use and water solutions, and residents who understand the importance of water to their lives and economy. An integrated One Water ethic is necessary to create the transformative change needed to meet the moment and the future.

ROBUST AGRICULTURE

Colorado’s culture, heritage, and economy, and it faces unprecedented challenges. Agriculture not only provides food and fiber, but it is also important to Colorado’s culture, heritage, and economy, and it faces unprecedented challenges. Innovations are needed to sustain irrigated agriculture, including strategies to stretch available water supplies, increase resiliency, enhance food production, and maintain profitability. Water supplies for Colorado’s urban growth should not come at the expense of our rural communities through indiscriminate buy and dry methods. Collaborative partnerships among agriculture, environmental groups, and municipal water providers should be used to create multi-purpose projects that help keep irrigated lands in production and maintain ecosystem services.

THRIVING WATERSHEDS

Colorado’s watersheds hold the future of our water supply security. Comprehensive water resources planning should incorporate conditions of forests, streams, wetlands, and wildlife habitat. As our state’s water source, the health of watersheds affects agriculture, downstream communities, recreation, tourism, and ecosystem function. Colorado will continue to follow a shared stewardship ethic to plan and implement multi-benefit projects to enhance the health of our watersheds.

RESILIENT PLANNING

Water security is critical to the quality of life, environment, and economy of Colorado. The future is uncertain, and Colorado needs to be adaptive and resilient to face the challenges ahead. Water security roadmaps, inclusively developed at a local level and informed by strong state leadership, can identify acute and chronic risks to water supply, integrate local planning strategies, prioritize collaborative solutions, and build adaptive capacity and resilience.

4 "One Water" means matching the right water to the right use. See glossary and Chapter 6 for details and graphic.
Tools for Action

address water issues and meet water needs. They include:

- Public outreach and education
- Land use and water planning integration
- Funding
- Data collection and sharing
- Policy and regulatory changes
- Water storage
- Watershed planning
- Water reuse
- Funding
- Sharing agreements
- Collaboration groups
- Conveyance infrastructure
- Watershed planning
- Water efficiency and conservation programs
- Climate adaptation
- Water reuse
- Innovation
- Collaborative water sharing agreements
- Equity
- Stream/watershed restoration and enhancement
- Endangered and threatened species recovery programs
- Flow enhancement and maintenance

Actions include:

**50 PARTNER ACTIONS**

While the list of partner actions is limitless, the Water Plan describes approximately 50 ideas for potential actions that could be supported by Water Plan grants.

- Increased personal conservation
- Starting a new water initiative/project
- Developing collaborative solutions

**50 AGENCY ACTIONS**

The Water Plan includes 50 actions CWCB and supporting agencies will take to help advance local initiatives that support the wise development and conservation of water resources.

- Developing frameworks and convening groups
- Advancing research and science
- Creating support tools
Chapter 1: Overview

Tracking Progress

This Water Plan replaces the previous plan with transparent and trackable actions. Partner actions will be tracked through CWCB’s increasingly modernized process for tracking of grants and loans as well as projects through the Project Database. As CWCB tracks the completion of the agency actions it leads, CWCB will also document major legislative and basin advancements that occur—especially where the State has played a role. Specific actions that inform the CWCB Board’s annual operating plans and processes like the next Technical Update offer opportunities to identify trends, analyze progress, and explore new data and information that will help CWCB stay nimble and responsive to shifting conditions. Implementing the plan embraces the spirit of resilience—being adaptive to both acute and chronic challenges. The Water Plan is meant to be broad and flexible enough to do all of this, but it needs you to help carry out the larger vision for water management in Colorado that uplifts all areas and people in the state.

The Path Forward

The Water Plan is a call to action. Answering the call is a commitment to long-term water collaboration, resolve in the face of adversity, and developing creative solutions that allow Colorado to advance within the bounds of our legal framework. Coloradans must come together across diverse groups and geographies to envision and implement actions that will move us closer to a resilient water future. This is how we keep Colorado strong.

OUTDOOR RECREATION IS NOT ONLY A KEY PILLAR OF COLORADO’S ECONOMY BUT ALSO A MAJOR CONTRIBUTOR TO OUR QUALITY OF LIFE, MENTAL HEALTH AND PHYSICAL HEALTH.

— CONOR HALL
Colorado Outdoor Recreation Industry Office Director
Water Plan Layout

Following this introduction, the Water Plan describes the critical elements of Colorado’s history, geography, legal setting, and water-planning efforts. The background and context provide key pieces of information that guide the direction of the Water Plan.

- Water Plan methods for analyzing future water conditions (Chapter 2)
- Geography, variability, and use of water in our state and legal underpinnings for managing it (Chapter 3)
- Basin context and summary information, including potential costs of projects to meet future water needs (Chapter 4)
- Tools that can be used to take action (Chapter 5)
- Statewide vision for a more water-resilient Colorado, along with partner and agency actions (Chapter 6)
- Process for tracking and updating the Water Plan (Chapter 7)

Accessing the Plan

The Water Plan allows the reader to engage at the levels that work best for them.

1. Executive Summary - High-level description and highlights of the Water Plan.
2. Water Plan (full document) - Foundational background information, future vision, and actions.
3. CWCB Website - Current CWCB efforts and background materials (cwcb.colorado.gov)

You can also find additional links and interactive resources at cwcb.colorado.gov

This updated Water Plan replaces the original Water Plan developed in 2015.
CHAPTER 2

TECHNICAL ANALYSIS, SCENARIOS, and DRIVERS
Following the launch of the Water Plan and the Basin Implementation Plans (BIP) in 2015, CWCB initiated the process of updating the underlying water supply and demand analyses, which culminated in the Analysis and Technical Update to the Colorado Water Plan (Technical Update), completed in 2019. The work began with the input of Technical Advisory Groups (TAG) that included representatives from across the state who provided expertise and advice on assumptions and methods for the Technical Update analyses. The resulting Technical Update (formerly known as the Statewide Water Supply Initiative or SWSI) established a new approach to statewide water analysis and data sharing.

The Technical Update leverages a significant investment of over three decades in statewide water modeling efforts, which began in 1992. To that end, the Technical Update provides a significant improvement in the scope, science, and approach to water supply planning. The approach positions Colorado for a streamlined and robust evaluation of its future water needs.

The 2015 Water Plan set an adaptive management framework for future water planning activities and described five plausible futures (or planning scenarios) under which demands, supplies, and gaps (difference between demand and supply) were to be estimated. The scenarios included new considerations, such as climate change, that were not a part of analyses prior to the 2019 Technical Update. In addition, CWCB has continued to work with the Division of Water Resources (DWR) to develop and refine consumptive use and surface water allocation models that were not ready for use in earlier analyses. The Technical Update data sets were developed to be readily updatable, and during the recent BIP update process some data sets were further refined with basin roundtable input. As a result of these factors, the Technical Update took a leap forward with a different and more robust approach to estimating future gaps.
Section 2 of the Technical Update (Volume 1) summarizes the methodologies used to estimate current and future municipal/industrial and agricultural demands, water supplies and potential gaps, and tools for evaluating environment and recreation needs. Volume 2 of the Technical Update includes technical memoranda with detailed descriptions of methodologies and analysis results. The methodologies used for the Technical Update build on previous datasets as well as new and improved data sources. To the extent possible, the Technical Update leveraged Colorado’s investment in models and datasets developed through Colorado’s Decision Support System (CDSS). Highlights of the new methodologies are described below.

- **Incorporation of scenario planning:** The 2015 Water Plan introduced scenario planning and included five scenarios that describe Colorado’s potential water situation in the year 2050. The Technical Update conducted analyses of future demands, supplies, and additional water needs in the context of the potential future scenarios.

- **Municipal water use efficiency reporting data:** New data describing recent municipal water usage was employed to estimate municipal water demands. The data are collected and reported by water providers pursuant to House Bill (HB) 10-1051 (1051 data). The 1051 data were not available in prior SWSI efforts.

- **CDSS tools:** The Technical Update made extensive use of modeling tools available through CDSS. CDSS is a water resources data and modeling toolbox developed by CWCB and DWR for each of Colorado’s major river basins for regional planning purposes. Tools in CDSS include HydroBase (a vast database of statewide water-related data), geographic information systems (GIS) data, surface water allocation models, and models that quantify consumptive use from crops and other vegetation. CDSS tools are available in most basins in the state. In basins where particular CDSS tools are not available, alternative methodologies were used to estimate demands and potential future gaps. The level of detail on hydrology, operations, and demands is appropriate for regional planning but does not capture daily changes in streamflow, routing of reservoir releases, or non-typical operations. As a result, the effect of local water uses on streamflows may not always be fully captured by the regional models.

- **Consideration of climate change:** The effects of climate change significantly influence hydrology, water demand and availability, and estimated gaps. Three of the five planning scenarios include assumptions and projections related to a hotter and drier future climate. The analyses considered temperature increases up to 4.2 degrees Fahrenheit and were consistent with projections in the Colorado Climate Plan. Projections of future climate change conditions were not a part of past SWSI analyses.

- **Quantification of an agricultural gap:** Water demands and shortages for irrigated crops at the field level were estimated in SWSI 2010 but were not quantified using surface water modeling. Using the full suite of modeling tools available from CDSS made it possible to estimate agricultural gaps in the Technical Update under current and planning scenario conditions. Agricultural gaps are described in two ways:
  1. **Total Gap:** The overall shortage of water supplies (current plus potential incremental increases) to meet agricultural diversion demands required to provide full crop consumptive uses.
  2. **Incremental Gap:** The degree to which the gap could increase beyond what agriculture currently experiences under water shortage conditions.

1 The planning scenarios developed for the Colorado Water Plan and the Technical Update were built on the foundational work of the multi-phase Colorado River Water Availability Study, Phase II (CRWAS-II). Detailed methodology and analysis results can be found in CRWAS-II Task 7: Climate Change Approach and Results.
• **Improved environment and recreation tools**: The Technical Update

In addition, the Colorado Environmental Flow Tool (Flow Tool) was developed by CWCB to help assess potential flow conditions and associated ecological health in river segments in each basin. The Flow Tool was built on the framework of the Watershed Flow Evaluation Tool, a Colorado-specific application of a framework for assessing environmental flow needs at a regional scale. The tool uses flow data from the surface water allocation modeling developed for the Technical Update.

### Risk of Future Water Shortages

In the Technical Update, the calculated difference between water supplies and water demands for current and future conditions in the municipal and industrial and agriculture sectors was labeled the "gap." Gaps were presented for each of the five planning scenarios to reflect future uncertainty. Because gaps are estimated for future scenarios, they represent a future risk that water supplies will not be adequate to fully meet municipal, industrial, and agricultural demands. The bigger the gap, the higher the risk that Colorado will not be able to meet its future water needs. In a similar vein, potential future risks for environmental and recreational attributes based on projected future flow conditions were evaluated in the Technical Update using the Flow Tool.

Identifying potential future risks to all sectors of water use was a key objective of the Technical Update. Risk identification is a starting point and is foundational for discussions about projects and strategies that will help lessen future risk. Chapter 3 of the Water Plan summarizes the results of analyses conducted during the Technical Update and enhanced during the BIP update process.

The Water Plan uses scenario planning to identify and assess several potential water futures that together capture the most relevant uncertainties and driving forces.
Develop projects or strategies to mitigate future risks

Calculate potential future risks of water shortages

Quantify future supply and demand conditions for each scenario

Evaluate drivers that impact future water conditions

Identify the most uncertain and impactful drivers

Develop future scenarios that consider variations in the drivers
Chapter 2: Technical Analysis, Scenarios, and Drivers

Before developing the 2015 Water Plan, CWCB initiated a multi-year stakeholder dialogue in conjunction with the nine basin roundtables and the IBCC to develop a methodology for projecting future water needs. The IBCC then developed a list of the following nine high-impact drivers that could greatly influence the direction of Colorado's water future. Several of these drivers are interrelated and can have integrated effects. The identification and monitoring of these nine drivers are important to understanding the direction of future water supply and demand.

1. POPULATION / ECONOMIC GROWTH

**DRIVER DESCRIPTION**

Population growth is driven by both state and national economic trends and land use planning and development statewide (see Driver #3). Colorado's moderate climate and quality of life draw both permanent residents and tourists. Population and economic growth/decline is forecasted by the State Demography Office (SDO) using census data and understanding of economic drivers.

**IMPACT ON WATER RESOURCES**

Population growth is a primary driver for municipal water demand and urbanization. Population change directly influences water use, while economic growth influences the types of water use (municipal, industrial, recreation, etc.). While Colorado's recent efforts to save water through efficiency and conservation have kept water demands steady in spite of growth, water demands are nevertheless projected to increase.

2. SOCIAL / ENVIRONMENTAL VALUES

**DRIVER DESCRIPTION**

Social/environmental values reflect the public's perception of water use, support of water and energy conservation, and allocation of water supply toward environmental uses. Social values influence drivers such as regulations and adoption of water efficiency technologies, but they also affect the types of solutions that Coloradans pursue to meet future water needs or respond to climate change. For example, social values can impact the degree to which residents voluntarily adopt water-efficient technologies that may cost them money. They can also influence the demand for local agricultural products and the desire to maintain open space. Personal experiences, education, and outreach impact the degree of public awareness of water issues, which in turn can affect the public's perception of the water supply solutions as well as recreation and environmental protections.

**IMPACT ON WATER RESOURCES**

If values trend toward greater water and energy conservation, new technologies may emerge that help conserve water. Also, development of new supplies may occur in ways that meet municipal and agricultural needs while preserving or enhancing the environment and providing recreational benefits.
3. URBAN LAND USE / URBAN GROWTH PATTERNS

DRIVER DESCRIPTION

Availability and adoption of water efficiency technology drives water demands from municipal, industrial, and agricultural perspectives. Increased efficiency can be implemented in all sectors (municipal, industrial, energy, agricultural) and can offset growth through decreased demand by individual users.

IMPACT ON WATER RESOURCES

Indoor municipal demands can be reduced by installing low-flow fixtures, and outdoor demands are influenced by types of landscaping and efficiency of irrigation systems. On the agricultural side, irrigation efficiency technologies can reduce water losses on-farm and in ditches that deliver water from rivers and streams to farms. In addition, crop hybrids that are drought tolerant and crops that require less water can reduce irrigation demand.

4. AVAILABILITY OF WATER EFFICIENCY TECHNOLOGIES

DRIVER DESCRIPTION

Availability and adoption of water efficiency technology drives water demands from municipal, industrial, and agricultural perspectives. Increased efficiency can be implemented in all sectors (municipal, industrial, energy, agricultural) and can offset growth through decreased demand by individual users.

IMPACT ON WATER RESOURCES

Indoor municipal demands can be reduced by installing low-flow fixtures, and outdoor demands are influenced by types of landscaping and efficiency of irrigation systems. On the agricultural side, irrigation efficiency technologies can reduce water losses on-farm and in ditches that deliver water from rivers and streams to farms. In addition, crop hybrids that are drought tolerant and crops that require less water can reduce irrigation demand.

5. CLIMATE CHANGE / WATER SUPPLY AVAILABILITY

DRIVER DESCRIPTION

Climate change is the long-term shift in temperature and regional weather patterns that results in a range of projected future conditions that include a warmer and potentially drier future for Colorado.

IMPACT ON WATER RESOURCES

Climate conditions impact both water supplies and water demands. Climate change may decrease streamflows and/or shift yearly streamflow patterns, which would impact agricultural, municipal, and industrial water supplies and create or increase risks for environment and recreation attributes. Higher temperatures associated with climate change will increase irrigation water demands for agricultural crops and outdoor urban landscapes and result in reduced return flows to streams.
6. LEVEL OF REGULATORY OVERSIGHT / CONSTRAINT

DRIVER DESCRIPTION

Regulatory oversight includes the legal framework in Colorado and nationwide through which water is administered, developed, and managed. This includes oversight from DWR, Colorado Department of Public Health & Environment (CDPHE), U.S. Environmental Protection Agency (EPA), and others.

IMPACT ON WATER RESOURCES

Regulatory constraints are influenced by social values, and they may drive changes in demands. For example, industrial water needs for energy extraction or thermoelectric energy production may be higher or lower in the future depending on state and local regulations and policies. Regulation can also drive the types of water supply solutions that stakeholders pursue. For example, the efficiency of permitting for certain types of water projects and the associated environmental mitigation requirements could influence their feasibility and cost.

7. AGRICULTURAL ECONOMICS / WATER DEMAND

DRIVER DESCRIPTION

Agricultural conditions, such as the amount of irrigated land in production, crops grown, and climate influence irrigation water demands. Urbanization, municipal transfers of agricultural water supply, and availability of surface and groundwater supplies all influence the amount of agricultural land that will be in production in the future. In addition, demands and prices for local agricultural products affect the economic sustainability of continued agriculture and resulting demands for water.

IMPACT ON WATER RESOURCES

Changes in the economics of the agricultural sector may impact the amount and types of crops grown, as well as the changes that will impact water demands for agricultural purposes.

8. ENERGY ECONOMICS / WATER DEMAND

DRIVER DESCRIPTION

The energy sector uses water in a variety of ways, including direct use for hydropower, or cooling. Water needs for energy expansion relative to population growth and current regulations, policies, and planning for the energy industry. These needs are also affected by the type of energy production that is used in the future and can be influenced by state and national energy policies.

IMPACT ON WATER RESOURCES

As the sources of energy shift from non-renewable (coal and gas) to renewable (water, wind, and solar), the demand for water will shift as well. It is anticipated that renewable sources of energy will be less water consumptive.

9. MUNICIPAL AND INDUSTRIAL WATER DEMANDS

DRIVER DESCRIPTION

The municipal and industrial sector serves the residents and businesses of Colorado with water. Municipal water demands are influenced by changes in other drivers such as population, urban land use, adoption of conservation measures, and climate.

IMPACT ON WATER RESOURCES

Water in Colorado is scarce, and as the industrial demand for water is met through industrial demand for water is met through...
Using these drivers, the IBCC developed five scenarios that represent how Colorado’s water future might look in 2050, knowing that the future is unpredictable and will contain a mix of multiple scenarios. A simplified graphic and descriptions of the five scenarios are shown below. The icons for each scenario illustrate the increase and decrease in levels for the generalized drivers compared to current levels (the five icons represent the combined effects of the nine drivers). The scenario names portray the overall story that each scenario tells in its respective views of the future.

### SIMPLIFIED DESCRIPTION OF PLANNING SCENARIOS

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<thead>
<tr>
<th>A Business as Usual</th>
<th>B Weak Economy</th>
<th>C Cooperative Growth</th>
<th>D Adaptive Innovation</th>
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- **Population growth increases at trends predicted by the SDO.**
- **Future hydrology, per capita water demands, and adoption of conservation measures are similar to what’s recently occurred.**

- **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.**

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

- **Both scenarios assume that the climate is much warmer and drier and that population growth is higher than projected.**
- **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.**

Click this link for more information on the scenarios (including full text descriptions of each scenario). Refer to the Technical Update to the Water Plan, Analysis and Technical Update.
Chapter 2: Technical Analysis, Scenarios, and Drivers

Monitoring the Drivers

The Water Plan will be updated periodically as part of a robust planning cycle to evaluate the state’s changing water conditions. Part of the periodic update process will include monitoring the status of water resources drivers and adjusting the planning scenarios based on observed trends. Some of the drivers (e.g., population, per capita municipal and industrial water demands) can be monitored with readily available data being collected by state and local entities. Other drivers (e.g., regulatory constraints and social/environmental values) may require specific data gathering, such as surveys or collaboration with other entities who collect these types of information.

The interactions of drivers and their impact on risk is complex, which underscores the need for consistent monitoring of the drivers during Water Plan implementation. If certain drivers increase future demand (e.g., urban or energy sector growth) or decrease water supply (e.g., drier climate, increased regulation), then the risk of a future water shortage may increase; however, the risk may not increase if new water-efficient technologies emerge.

Actions can be taken that are useful in any future scenario

Near-term strategies and actions can be taken that provide benefits regardless of how the future unfolds (also known as “low regret strategies”). As future Technical Updates are conducted and the Water Plan is updated, new near-term strategies will be developed to adapt to conditions and lower our water-related risks.

Monitoring and Uncertainty

Our future is uncertain, which is why monitoring is critical for identifying trends and adaptively planning for the future. For example, using SDO population projections developed in 2017 as a foundation, the Technical Update estimated a 2050 statewide population range of 7.7 million to 9.3 million. The SDO estimate, prepared in October 2022, projects a 2050 population of 7.5 million, which corresponds closely to the projection in the Weak Economy scenario. Trends in population and other water supply and demand drivers need to be monitored so that the Water Plan can adapt to uncertain and changing future conditions. The CWCB monitors drivers, identifies changes in drivers during Technical Updates, evaluates whether recent changes signal long-term trends, and assesses how trends may affect the future.
**WE'RE TRYING TO PACE THE RIGHT FUTURE GOALS. DROUGHT, CLIMATE CHANGE...IT WOKED US UP. MOTHER NATURE CHANGED HER PROCESSES. THE VISION OF THIS ORGANIZATION OVER THE LAST TWO DECADES OR MORE IS THE ONLY WAY WE'RE GOING TO PROTECT OURSELVES IN THE NEAR FUTURE.**

— RUSS GEORGE, Former CWCB Board and IBCC Director
CHAPTER 3

STATE CONTEXT
Colorado’s geography is diverse with terrain that ranges from low-lying plains to the second highest peak in the lower 48 states, Mt. Elbert. The varying terrain influences precipitation amounts and patterns across the state. Many major rivers originate in the high Rocky Mountains, including the four major river systems of the Arkansas, the Colorado, the Platte, and the Rio Grande. These rivers flow east, west, north, and south from Colorado’s mountains and plains out of the state, through 19 downstream states and Mexico, and into the Gulf of Mexico or the Pacific Ocean.

Our state’s water supply consists of both surface water and groundwater sources, and these supplies depend on weather, and our legal system of allocating water for beneficial use. Colorado’s rivers and streamflows are highly variable, both seasonally and annually, and provide surface water and replenish alluvial groundwater supplies. The quality of surface water and groundwater also influences the amount available for different uses. As described in this chapter, the use of groundwater and surface water is subject to different water rights and management institutions.

Surface water supplies the majority of water use in Colorado, but groundwater is a significant and critical resource in many regions for agriculture and municipalities.
Surface Water

The eight major river basins in Colorado depend on winter snowpack and spring runoff to replenish and sustain their flow. Colorado has agreements with neighboring states, and Colorado water users have a long legacy of using water responsibly in order to meet Colorado's water commitments.

The western side of the Continental Divide receives most of the precipitation (80%); however, the majority of the population (nearly 90 percent) lives on the eastern side of the Continental Divide. Because streamflows are not evenly distributed across the state, water managers rely on networks of reservoirs, pumps, tunnels, and ditches to store and move water. They also must comply with relevant environmental mitigation requirements to maintain ecosystem health. Water conservation strategies can help alleviate stress on the system under both normal operating conditions and during shortages.

Relative Variability of Typical Wet-and-Dry Surface Water Hydrology

Annual streamflow varies significantly across Colorado’s river basins.
Chapter 3: State Context

Groundwater

Groundwater plays a major role in the statewide water supply. Nineteen of Colorado's 64 counties and about 20 percent of the state's population rely heavily on groundwater. Most groundwater use occurs in the eastern part of the state and in the Rio Grande Basin. The western slope, which includes the basins tributary to the Colorado River, has not developed groundwater to the same extent due to depth of groundwater in some areas and historical abundance of Colorado River supply, though some domestic water suppliers rely on alluvial aquifers. Groundwater aquifers are naturally-formed storage and do not lose water to evaporation. Nevertheless, relying on groundwater as a primary supply may be challenging due to uncertain and varied natural recharge rates, water quality issues, constraints on operations (e.g., costs and water rights), and potential future changes to the physical characteristics of the aquifer (such as reduction in storage volume due to compaction). In some aquifers, such as those in the Denver Basin, the natural recharge rate is very low compared to extraction rates, so groundwater is considered a nonrenewable resource.

Groundwater resources exist throughout the state in alluvial and bedrock aquifers. Bedrock aquifers include sedimentary (i.e., porous) multi-aquifer systems such as the Denver Basin and Dakota-Cheyenne aquifers. Crystalline (i.e., non-porous) rock aquifers are found in most of the foothills and mountainous areas of the state and are formed as snow melts into rock fractures. Alluvial aquifers generally consist of sands and gravels, occur along many of the state's streams, and are usually tributary to the stream. Alluvial aquifers are a key component of water supply in parts of Colorado. Because of the connection between alluvial aquifers and surface water systems, alluvial water is often used conjunctively with surface water through augmentation plans.

High Plains Aquifer – Arkansas Basin

Southeastern Colorado's community and irrigated farmland water sources are from aquifers, including the Southern High Plains Designated Groundwater Basin (which lies outside of the Arkansas Basin). Groundwater elevations in the area have generally been dropping, with declines between 3.5 to 21 feet from 2008 to 2018. The gradual depletion of these aquifers is a serious issue that will require further attention and planning.

High Plains Aquifer – Republican Basin

The Republican River Basin has nearly 580,000 irrigated acres, making it one of the highest producing basins of irrigated crops in the state. The basin has very limited surface water supplies. As a result, irrigators rely on groundwater supplies from the High Plains Aquifer. While all pumping in the basin is subject to the Republican River Compact, the Compact accounting recognizes that most of that pumping comes from storage in the High Plains Aquifer and not the stream system.

The current amount of irrigated land in the basin is expected to decline in the future, and irrigated lands will need to be retired to maintain compliance with the Republican River Compact. In addition, declining saturated thickness in the High Plains Aquifer will also lead to the retirement of groundwater-irrigated lands.

Denver Basin Aquifer – South Platte and Arkansas Basins

The Denver Basin Aquifer has provided a high-quality and plentiful supply to both urban and rural areas along the Front Range, with significant well development since the 1950s. During the drought of 2002, declines in the Arapahoe formation, and even drying-up of wells along the aquifer's western edge, were observed. While the Denver Basin Aquifer can be a viable water supply, it is challenged by uncertainty in statutory allocation of water and declining water levels that may limit its use to only drought resilience in some areas. Concerns about the sustainability of the Denver Basin Aquifer have driven many municipalities to pursue costly renewable surface water supplies.

San Luis Valley Aquifers – Rio Grande Basin

Since 1977, pumping of groundwater for irrigation has resulted in an estimated reduction of water stored in the unconfined Closed Basin aquifer of approximately 1.2 million acre-feet. As early as the 1970s, water users in the San Luis Valley recognized the need to monitor groundwater use and protect both surface and groundwater supplies. In 1998, the Colorado General Assembly passed HB 98-1011, which instructed the State of Colorado to conduct a study of the San Luis Valley's hydrologic resources and resulted in the Rio Grande Decision Support System (RGDSS) groundwater model. RGDSS modeling and case law show that the San Luis Valley's streams, wetlands, and aquifers are hydrologically connected, and that groundwater withdrawal results in stream depletions.

In the early 2000s, San Luis Valley water users grew increasingly concerned about groundwater use and over appropriation. In 2004, at the urging of San Luis Valley water users, the Colorado General Assembly enacted Senate Bill (SB) 04-222, which instructed the State Engineer to develop groundwater rules and regulations to prevent injury to water right holders, provide for sustainable groundwater supplies, and prevent interference with the Rio Grande Compact. SB 04-222 also enabled the formation of Groundwater Management Subdistricts (subdistricts), which are a system of self-regulation, including economic-based incentives to reduce groundwater use and collective efforts to ensure the protection of senior surface water rights.

The State Engineer submitted Well Rules and Regulations (well rules) in 2015 for existing and new uses of groundwater in Division 3. The well rules came into effect in March 2021 and require well owners to achieve sustainable aquifer levels and replace injurious stream depletions to surface water rights by either joining a subdistrict or creating or joining an augmentation plan.

Water users across the San Luis Valley continue to work toward sustainable aquifer levels by utilizing conservation programs, innovative water efficiency improvements, and land fallowing programs.

Declining aquifer levels in several Colorado basins require proactive management of this resource. Strategies being used to keep these aquifers sustainable include monitoring and reductions of well pumping, augmentation and conjunctive use of groundwater supplies to replenish surface water systems or remedy impacts of pumping groundwater, and even retirement of irrigated parcels.

According to PRISM Climate Group 30-year normals from 1991 to 2020, Colorado receives an average of 18 inches of precipitation each year. However, extreme variability exists across the state and within relatively short distances. For example, Wolf Creek Pass yields an annual average of more than 60 inches of precipitation, while Center receives just 7 inches of precipitation annually. Both sites are in the Rio Grande Basin.

Our state’s variable precipitation patterns create considerable fluctuations in hydrology. Floods and drought are possible within the same year. Three of Colorado’s worst droughts have occurred in the last 20 years — 2002, 2012, and 2018 — with historic precipitation at some locations during the same 20-year period — 2003, 2011, 2013, and 2015. As depicted previously, average annual precipitation varies geographically across the state. In addition, conditions within a single year can simultaneously vary throughout the state with drought conditions in one part and relatively normal or wet conditions in another.

Drought can have substantial and lasting effects on water supplies and availability for years, while wet years offer relief and the opportunity to store excess water. Both weather extremes can have other consequences, such as increased wildfires and the flooding and debris flow that potentially follow.

Aside from the potential for wildfire, drought can also have substantial fiscal impacts. Colorado State University estimates that in 2012, lost revenues due to drought in the agricultural sector alone exceeded $409 million. Factoring in secondary economic effects to local communities, the loss increases to $726 million.

Drought can also negatively influence air and water quality, water delivery infrastructure, wildlife, the environment, recreation, and tourism. Drought can last for weeks, months, or years. The longer a drought persists, the larger its effect. For instance, a municipality may be able to get through a single-year drought by using reservoir storage and drought response measures, but if stored supplies are not replenished, subsequent years become more difficult to manage. The same is true in the agricultural sector; ranchers forced to cull herds in response to drought or the loss of orchard trees may require decades to recover or may never recover at all.

On the other end of the variability spectrum are floods—too much moisture can result in overflowing streams and reservoirs and cause extensive damage. In fall 2013, widespread flooding occurred along the northern Front Range (in the South Platte and Arkansas Basins) after 19 inches of rain fell in a few days. For these areas, the rainfall was equivalent to nearly a full year of precipitation. As many as 88 weather stations exceeded 24-hour precipitation records, and the hardest hit areas received more than 600 percent of average precipitation for the month. Water inundated entire communities. Floods not only cause community damage, they also impact agricultural operations, drinking water supply, and water delivery systems. Flooding events can leave water supply infrastructure, such as diversions and headgates, completely disconnected from their historical source of water. These effects may take weeks, months, or years to fully repair, and some damage may be too great to ever repair economically.

The Colorado River Basin is currently experiencing its worst drought in recorded history. Since 2000, it has experienced the driest period in 1,200 years. The Colorado July Palmer Drought Severity Index uses temperature and precipitation data to estimate relative dryness and quantify long-term drought. The 1970–1999 average was +0.9, or wetter than normal, while the 2000–2018 average is –1.7, or drier than normal.

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6 Updated and adapted from Lukas et al., Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaption. 2014. Western Water Assessment. Data: NOAA NCEI.
Uncertainties Affecting Supply - Climate Change

Colorado’s water supplies are affected by temperature and precipitation patterns, and these historical patterns have begun to change. In May 2021, NOAA updated its 30-year climate normals, and the newest 30-year normal reflects warmer temperatures than previous iterations and also reflects changing precipitation patterns. For Colorado water supplies, this presents additional complexities and uncertainties, and points to a shift toward aridification. Some key hydrologic indicators that could be impacted by climate change are listed to the right.

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>CLIMATE CHANGE EFFECT</th>
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<tr>
<td>Annual Streamflow</td>
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<tr>
<td>Peak Runoff Timing</td>
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<td>Crop Water Demand</td>
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<td>Snowpack</td>
<td>Decreases in most projections</td>
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<tr>
<td>Palmer Drought Severity Index</td>
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<tr>
<td>Heat Waves</td>
<td>More frequent</td>
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<tr>
<td>Cold Waves</td>
<td>Less frequent</td>
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In the Upper Colorado River Basin (i.e., the states of Colorado, New Mexico, Utah, and Wyoming), recent research from the U.S. Geological Survey indicates that streamflow is decreasing by about 5 percent per degree Fahrenheit as a consequence of atmospheric warming, causing a 20 percent reduction over the past century.

Recent statewide temperatures in Colorado have been trending up. Colorado’s statewide annual temperature anomaly (deviation from the long-term average) indicates that Colorado’s average yearly temperature has increased 2°F in the last 30 years.

Colorado has warmed 2°F in the last 30 years, and although models differ about the range of future conditions, it is predicted that Colorado will continue to warm by an additional 2.5°F to 5°F by mid-century.

Precipitation is widely variable in the state, with 5-year averages (represented by green bars) generally falling below the long-term average since 2000.

The graph above compares annual precipitation totals (dotted black line) to 5-year average precipitation totals (green bars) and long term average (solid black line). Average precipitation numbers can mask the high variability in precipitation seen at an annual or even 5-year average scale.\(^8\)

\(^8\) NOAA National Centers for Environmental Information. State Climate Summaries 2022 Colorado. 2022 Colorado Climate Summary

\(^9\) Ibid.

Colorado has warmed 2°F in the last 30 years, and although models differ about the range of future conditions, it is predicted that Colorado will continue to warm by an additional 2.5°F to 5°F by mid-century.
Due to the uncertainty associated with future impacts of climate change, a hotter and drier future was included in the scenario planning process described in Chapter 2. Three scenarios have a climate different from what was observed during the 20th century, including two scenarios that experience “hot and dry” conditions, and one that features a hydrology and climate described as “between 20th-century-observed and hot and dry.”

**A Business as Usual**

None

**B Weak Economy**

None

**C Cooperative Growth**

+ 3.8° F

+ 5% Annual Precipitation

**D Adaptive Innovation**

+ 4.2° F

- 1% Annual Precipitation

**E Hot Growth**

+ 4.2° F

- 1% Annual Precipitation

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**Dust-On-Snow Events**

“Dust-on-snow” events also introduce a level of uncertainty into managing water supplies. Dust-on-snow events occur when wind deposits dust from southwestern deserts (and other loose-soil surfaces lacking vegetation) onto mountain snowpack. This increases the effect of solar radiation, which speeds snowmelt and leads to earlier spring runoff. Studies have shown that dust events can advance snowmelt timing, enhance snowmelt runoff intensity, and decrease snowmelt yields. Dust-on-snow events can result in peak runoff three weeks earlier than normal. This shift is independent of climate change, which may also result in earlier snowmelt patterns. Since 2005, when dust tracking began, 140 dust-on-snow events have occurred. Eleven of these events were observed during the winter of 2022. The severity of future dust-on-snow events is uncertain. Nevertheless, if events continue at recently observed rates, they will affect Colorado’s present and future water supply.
Historical Climate Extremes

Tree-ring reconstructed water-year streamflows as % of observed mean, showing the 10-year running average, for four gages representing major Colorado basins: the Colorado River at Lees Ferry, AZ (shown from 1000–2005), the South Platte River at South Platte, CO (1634–2002), the Rio Grande at Del Norte, CO (1508–2002), and the Arkansas River at Salida, CO (1440–2002). All four records show the occurrence of droughts prior to 1900 that were severe and sustained over many years. The yellow shading highlights several notable multi-decadal paleodroughts, in the mid-1100s, the late 1200s, the late 1500s, and the late 1800s.10

The current trend toward aridification and the knowledge that severe, long-term drought has occurred in Colorado’s past underscores the need to be prepared for a warmer and drier future.

10 TreeFlow. Streamflow reconstruction from tree rings. Treeflow reconstructed streamflows
Aridification is defined as the extreme dryness that leads to a more permanent dry climate. This is different than drought, which focuses on lack of precipitation. Unlike drought, which focuses on lack of moisture, the focus of climate science has begun to include the growing role warming temperatures are playing as a potent driver of greater aridity: hotter climate extremes; drier soil conditions; more severe drought; and the impacts of hydrologic stress on rivers, forests, agriculture, and other systems. This shift in the hydrologic paradigm is most clear in the American Southwest, where declining flows have been documented in the region’s two most important rivers, the Colorado and Rio Grande. However, the hydrologic shift may also impact areas east of the Rocky Mountains, based on findings of temperature-driven river flow declines in the Missouri River basin.

Increasing temperature-driven aridity is more often framed in the West in terms of episodic drought. This drought framing is also common among many water and land managers as well as the public and implicitly assumes an end to arid conditions must come with the return of rain and snow. However, anthropogenic climate change calls this assumption into question because we now know with high confidence that continued emissions of greenhouse gases into the atmosphere result in warming, and that this continued warming makes more widespread, prolonged, and severe dry spells and drought almost a sure bet. This translates into an increasingly arid Southwest and West, with progressively lower river flows, drier landscapes, higher forest mortality, and more severe and widespread wildfires.

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What is drought resilience?

Colorado has experienced long-term warming and drying—often referred to as aridity. Despite this overall trend, droughts and wetter periods still occur. Drought periods can be relatively long (multi-year) or fairly short (occurring in a single year or part of a year). Long-term climate trends toward aridity can amplify drought conditions and cause longer and more intense droughts. Drought resilience means building strategies that reduce the impacts of drought shocks and ongoing climate change, allowing communities, economies, and ecosystems to rebound more quickly when drought occurs.

The term “drought” is often applied in a variety of ways to describe conditions of water stress. Resilience strategies need to consider the multiple ways in which drought can occur. In addition, droughts can be widespread and have state-level impacts, and they can be more local and be felt disproportionately in a region. Several ways in which “drought” describes water stress are described below:

- **Periods of low precipitation** are described as “meteorological drought.” These periods can be long term and last several years or could be short term over a season or year. High temperatures, reduced runoff, and increased evaporation typically occur in meteorological droughts.
- **Impacts to water supply**, such as reduced streamflow, low inflows to reservoirs, and declines in groundwater aquifer levels are known as “hydrologic drought.” In addition to impacting water supply, hydrologic drought can lead to the loss of wildlife habitat and impact aquatic species.
- **Impacts to agriculture**, such as poor soil moisture and reduced water supplies from surface and groundwater sources lead to “agricultural drought.” Plant stress and low crop yields can result from agricultural drought.
- **Impacts to ecology** that push ecosystems toward lasting change from which recovery is difficult is known as “ecological drought.” Conditions causing ecological drought can be both natural and human caused.
- **Impacts to our economy** that are driven by other types of droughts can result in shortages of goods such as fruits, vegetables, grains, and meats, or services such as rafting. Weather-related water supply deficits that cause shortages of goods or services is known as “socioeconomic drought.”

Even as our hydrology trends toward aridification (extreme dryness that leads to a more permanent dry climate), wetter periods will still occur as well as acute and multi-year droughts.

**Colorado’s trends**
- Had three of the top five driest years on record since 2000
- Experienced a 2° F increase in average air temperature in the last 30 years
- Had generally below average precipitation since 2000
- Drought frequency has increased

**Drought impact examples**
- Municipal water shortages
- Warmer water temperatures, affecting aquatic life
- Agricultural surface water shortages resulting in reduced irrigation supplies
- Storage depletions
- Increased draw on groundwater aquifers
- Reduced recreation opportunities
- Increased wildfire risk, decreased forest health, and increased algal blooms
- Degradation of water quality through reduced streamflows and dilution of pollutants
Drought response

Because drought can vary in duration, severity, and geographical extent, determining the response can also vary. Local, acute drought may be mitigated with targeted solutions (e.g., reservoir releases or collaborative water sharing agreements), while long-term drought will need drought planning and response measures to mitigate impacts across all sectors. The CWCB has long supported drought planning through multiple efforts, including grant funding, drought planning support, and the management of various drought planning groups, including the Water Availability Task Force—a group that meets monthly to monitor current conditions. The Water Plan also serves as an educational tool to highlight the importance of drought resilience and the possible solutions that will need to be explored and implemented. Some examples include:

- **Municipal Water Conservation** — outdoor watering restrictions, water use codes and ordinances, strategic pricing, conservation-based water rate structures, turf replacement, and leak detection and repair.

- **Water Reuse** — treating municipal wastewater for reuse, including both non-potable uses, such as irrigation and aquifer recharge, and potable uses allowed by CDPHE’s Water Reuse Regulation 11.

- **Public Education and Outreach** — encouraging water conservation through education campaigns to all age groups.

- **Collaborative Water Sharing Agreements** — allowing water to be leased between partners during times of drought while avoiding permanent transfers.

- **Agricultural Water Conservation** — irrigation and delivery system improvements, improved soil health, soil moisture monitoring, drought-resistant crop selection.

- **Multi-Purpose Storage Projects** — maximizing the multi-purpose benefits of new and existing storage projects.

- **Collaboration** — developing trust and partnerships that create agreements and flexibility and timing of operations that can support increased flexibility in water use within the Prior Appropriation System.

- **Land Use Planning** — practices from forest management to embracing One Water planning (see Chapter 6 — Vibrant Communities), land use code changes, and green infrastructure.

- **Strategic Funding** — targeted investments that build drought resilience in cities (municipal drought funding reserves, low-water landscapes), watersheds (forest treatments, stream improvements), and on farms (greenhouses, rotational fallowing, reduced overgrazing).

A few examples are listed above, with more discussion of solutions in Chapter 5. Because drought is complex and reaches across multiple sectors, the implementation of strategies should be done in a multi-pronged and integrated approach to optimize resilience. Coloradans will need to work across each of the four action areas of the Water Plan to identify collaborative drought resilience strategies for cities, farms, streams, and people. The Water Plan describes several new actions in Chapter 6 for supporting drought preparedness and response that encompass education, collaboration, and tool development to support drought planning efforts.

Building resilience means addressing drought at every level and understanding where there are opportunities to collaborate on solutions that can create better outcomes for Colorado — especially where human induced impacts can be lessened. This includes not just surface water issues but also issues related to drought and groundwater (what the United States Geological Survey [USGS] has called a “groundwater drought”).

The combined risks of drought length and frequency is expected to increase due to climate change. While the impacts of drought can be reduced when followed by a wet period, projected increases in the frequency and duration of drought will require planning and innovation to mitigate the risk to our water supplies.
Colorado uses 40%
8,177,000AF
60% Leaves the state
5,340,000AF

To plan for the road ahead, it is essential to understand the many ways in which Coloradans use water throughout the state and how these uses are connected. Municipal and industrial demands will likely increase, more people will seek rural economies and food production. Open space and habitat are also supported. Streamflows support environmental and recreational uses that bring people to Colorado.

Colorado Water Consumption:
- Agricultural – 4,844,000 acre-feet (~90%)
- Municipal – 380,000 acre-feet (~7%)
- Industrial – 116,000 acre-feet (~3%)
- Streamflows support environmental and recreational uses.

The total amount of water that originates within Colorado averages 13.5 million acre-feet per year. More than 60 percent of this water is provided to the 19 states and Mexico that depend on Colorado’s headwaters. Less than 40 percent, or 5.3 million acre-feet, is consumed on average per year in Colorado.

Reliance on Return Flows:
Colorado often uses water multiple times, and many users depend on return flows for their supply. For example, delayed return flows from irrigation recharge aquifers and increase baseflows, which benefit municipal users and may benefit aquatic habitat in some instances.

HOW RETURN FLOWS WORK

Municipal Use Supports
- W \(\rightarrow\) \(\rightarrow\) \(\rightarrow\) \(\rightarrow\) \(\rightarrow\)
- K \(\rightarrow\) \(\rightarrow\) \(\rightarrow\) \(\rightarrow\) \(\rightarrow\)

Agricultural Use Supports
- Z \(\rightarrow\) \(\rightarrow\)
- ë \(\rightarrow\)
- K \(\rightarrow\) \(\rightarrow\)

Streamflow Supports
- K \(\rightarrow\) \(\rightarrow\) \(\rightarrow\) 
- Z \(\rightarrow\) \(\rightarrow\) \(\rightarrow\) 
- ë \(\rightarrow\)

Unused water returns back to river (“return flow”)

Water is diverted for another use

Return flow from upstream will support downstream water uses and habitat.
The Colorado way of life depends on water development and conservation.

SB 14-115 defines the primary purpose of a state water plan is to determine state policy regarding the optimal conservation and development of Colorado’s water resources.

Colorado Department of Agriculture.


The Colorado way of life depends on water development and conservation.

Water is foundational to our economy

$47\text{ BILLION}$

Irrigated agriculture contributes $47 billion to Colorado’s economy annually.$^{14}$

$19\text{ BILLION}$

Water-related recreation contributed nearly $19 billion to Colorado’s economy in 2019.$^{15}$

$366\text{ BILLION}$

Colorado’s 2021 Gross Domestic Product was estimated at $366 billion.

Water development has made our way of life possible.

- **Infrastructure is complex:** Water infrastructure crisscrosses Colorado with irrigation ditches, reservoirs, pipelines, pumps, and facilities to clean our water.

- **Our infrastructure is aging:** Many agricultural water projects were built over 100 years ago, and our municipal and Tribal water infrastructure is aging as well. Improvements and upgrades are needed.

- **New projects are needed:** Colorado continues to grow, and $20 billion may be needed for municipal supply and conservation projects alone.

Water storage has been and will continue to be a critical tool for managing water supplies. Whether storing water above ground in reservoirs or below ground in aquifers, above- and below-ground storage facilities will need to meet multiple needs and be more flexible and less impactful in the future.

$^{13}$ SB 14-115 defines the primary purpose of a state water plan is to determine state policy regarding the optimal conservation and development of Colorado’s water resources.

$^{14}$ Colorado Department of Agriculture. Colorado Agriculture.

Water conservation preserves our way of life.

• **Colorado is saving water:** Colorado has invested in water conservation and efficiency, resulting in a 5% reduction in per capita municipal water use since 2008.

• **Conservation is important but complex:** Water efficiency and conservation in cities and towns saves water but can reduce revenues to water providers. Agricultural water efficiency aims to apply water according to plant demands and can lead to higher consumptive use, thereby reducing excess runoff that contributes to return flows.

• **Conservation is critical to our future:** Conservation will be critical to stretching municipal and agricultural supplies as Colorado grows. Using water wisely helps preserve water for the environment and recreation while maintaining our economy and building resilience for an uncertain future.

The Technical Update to the Colorado Water Plan estimated that water conservation and efficiency measures could reduce our potential future water needs by 300,000 acre-feet per year assuming high population growth and a future climate that is warmer and drier.

What is the right balance of water development and conservation?

**It's complicated.**

Investments are needed in both.

Investments should align with the Water Plan.

**PARTNER ACTIONS**

While the list of partner actions is limitless, the Water Plan describes approximately 50 ideas for potential actions that could be supported by Water Plan grants.

**50 PARTNER ACTIONS**

**AGENCY ACTIONS**

The Water Plan includes 50 actions CWCB and supporting agencies will take to help advance local initiatives that support the wise development and conservation of water resources.

**50 AGENCY ACTIONS**

**THESE INCLUDE ACTIONS AROUND**

- Project development
- Policy development
- Education and outreach

**THESE INCLUDE ACTIONS AROUND**

- Water conservation
- Water efficiency
- Water use optimization

See the full list of **50 ACTIONS** in the Water Plan at www.CWCB.org/WaterPlan

While the list of partner actions is limitless, the Water Plan describes approximately 50 ideas for potential actions that could be supported by Water Plan grants.

The Water Plan includes 50 actions CWCB and supporting agencies will take to help advance local initiatives that support the wise development and conservation of water resources.
Current SDO estimates project that Colorado will grow to 7.5 million by 2050, which is 18% less than projections in the 2015 Water Plan.

Per capita baseline system demand has decreased from 172 to 164 gpcd, which is a 5% reduction in demands between 2008 and 2015.

At the time of the Technical Update, the statewide population was 5.4 million and was estimated to grow to 8.5 million by the year 2050 according to prior SDO projections. To capture the range of population growth described in the planning scenarios, low and high statewide projections developed for the Technical Update range from 7.7 million to 9.3 million. After the Technical Update was completed, newer SDO projections suggest 2050 population will be 7.5 million, similar to the low end of the range in the Technical Update.

One acre-foot of water supports two families of four to five people for one year.
On average, industrial diversion demand is 13% of the total municipal and industrial demand. This includes snowmaking, thermoelectric generation, energy development, and large industrial users.

The Adaptive Innovation scenario assumes a water conservation ethic, which can help offset impacts of climate change and higher population growth.

Municipal and industrial users do not currently experience a gap, but increasing population and potentially hotter and drier future climate conditions will increase the risk of gaps and create a need for additional supply.

**Average Annual Statewide M&I Demand by Basin**

<table>
<thead>
<tr>
<th>Basin</th>
<th>Baseline</th>
<th>Business as Usual</th>
<th>Weak Economy</th>
<th>Cooperative Growth</th>
<th>Adaptive Innovation</th>
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**Statewide M&I Gap by Basin**

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Currently, 3.28 million acres of agricultural land are irrigated statewide. Irrigated agriculture supports a wide network of producers of agricultural goods to support nearly 195,000 people.

Irrigation acreage drives agricultural demand. Over a quarter of the irrigated acreage in Colorado is in the South Platte Basin. The Arkansas, Rio Grande, and Republican River Basins also have significant acreage, each with approximately 15 percent of the statewide total. Grass pasture is the state's predominant crop, particularly in the western slope basins. Irrigation supports a wide range of crops grown in Colorado including alfalfa, wheat, cereals/grains, fruits, vegetables, sugar beets, hemp, other oil seed crops like sunflower, and flowers. Much of the irrigated acreage supports ranching operations, either through grass hay production for livestock or irrigated pasture grazing.

In all basins where significant agriculture is forecasted to come out of production, overall irrigation diversion demands will decline due to the decrease in irrigated acreage even as the plant demand for irrigation on the acreage that remains increases due to higher forecasted temperatures.

Agriculture diversion demand represents the amount of water that would need to be diverted or pumped to meet the full crop irrigation water requirement. In the Technical Update, future projected agricultural diversion demands were adjusted to reflect:

- Urbanization
- Planned Agricultural Projects
- Groundwater Acreage Sustainability
- Climate

Groundwater supplies about 19% of overall agricultural demand and occurs primarily in the Arkansas, South Platte/Republican, and Rio Grande basins where irrigation from wells is prominent.
Stakeholders suggest 33,000 to 76,000 irrigated acres may be lost from planned buy and dry transfers, which is three times higher than the 2015 Water Plan estimate. Substantially more could be lost in the future from transfers not yet planned.

On average, approximately 80% of the overall agricultural diversion demand is currently met – and 20% is unmet – on a statewide basis, though this varies in each basin. This unmet demand contributes to a “baseline gap” for agriculture in each basin.

Future statewide agricultural diversion demand estimates range from 10 million acre-feet per year (AFY) in Adaptive Innovation to 13.5 million AFY in Hot Growth. For basins with significant irrigated acreage reductions, demands in all planning scenarios are projected to be lower than current demand. These reductions are driven by urbanization (South Platte), agricultural-to-municipal water transfers (South Platte and Arkansas), and aquifer sustainability requirements (Republican and Rio Grande).
Recreational attributes in the Focus Area include attributes such as coldwater fisheries, boating, and wetlands. It also includes boating data in its analysis.

Colorado's robust ski industry uses snowmaking to supplement snowfall. Water demands for snowmaking appear under the self-supplied industrial data in the Technical Update.

The outdoor recreation industry provides the backbone of a sustainable economy in many communities across Colorado, especially on the West Slope. Investments in water-based recreation have provided economic diversification.

The Flow Tool compares modeling outputs from the five planning scenarios against baseline flow conditions. Key outputs include a comparison of monthly flow regimes relative to ecological-flow indicators. The Flow Tool serves as a resource to help basin roundtables and other stakeholders identify and prioritize environmental and recreational restoration and enhancement projects and to better understand risks to ecological attributes based on possible future flow conditions under each planning scenario. Modeling flows at selected nodes across the state under the five scenarios resulted in identifying several risks. For more information on the Flow Tool and its limitations, see the Technical Update.
Focus Area Maps and Stream/Watershed Planning

Earlier runoff may result in mismatches between peak flow timing and aquatic species needs. Drier conditions in late summer could increase risk to fish due to higher water temperatures and impacted habitat.

Watershed and Forest Health

Forest health is a part of watershed health. We need to support and learn from working groups to improve our efforts. Forest health is a part of watershed health, and recreational values are located and/or where these attributes may be at risk.

Focus Area Maps

Stream Management Plans

Integrated Water Management Plans

1. Forest health is a part of watershed health
2. We need to support and learn from working groups to improve our efforts.
3. Forest health is a part of watershed health.
4. Recreational values are located and/or where these attributes may be at risk.
5. Forest health is a part of watershed health.
6. Recreational values are located and/or where these attributes may be at risk.
7. Forest health is a part of watershed health.
8. Recreational values are located and/or where these attributes may be at risk.
9. Forest health is a part of watershed health.
10. Recreational values are located and/or where these attributes may be at risk.

Colorado Water Plan Environment and Recreation Focus Area Maps

Colorado Water Plan Environment and Recreation Focus Area Maps provide a tool for roundtables and stakeholders to identify where additional planning and environmental and recreational projects are needed. General descriptions of Focus Area maps, SMPs, and IWMPs are below.

Focus Area Maps

Stream Management Plans

Integrated Water Management Plans

Focus Area Maps

Stream Management Plans

Integrated Water Management Plans

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Colorado Water Plan Environment and Recreation Focus Area Maps

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20 CWCB. 2021. Forest Health Study: 10 Takeaways to Inform the Colorado Water Plan.
Summary of Statewide Findings

Findings and Future Risks

Findings and Future Risks

- While per capita usage is expected to decrease in all basins, it is expected to increase 13 percent in the southwest and 17 percent in the northeast due to expected growth and climate change.

- Under climate change scenarios, earlier snowmelt and runoff may shift as much as one month earlier, potentially impacting water right yields.

- Increasing temperatures and longer growing seasons due to climate change will increase agricultural water demand.

- Projected future streamflow in most locations across the state show potentially drier conditions in the late summer months under scenarios with climate change, and peak summer flows that can help mitigate climate change risks to the environment and recreation.

- Making additional tools that provide for species recovery, habitat replacement and protection, and re-timing of flows that can help mitigate climate change risks to the environment and recreation.

- In mountainous regions, risks to environmental and recreational resources that may be exacerbated by climate change; however, some streams to environmental and recreation resources that may be increased risk by out-of-basin water transfers, may see increased risk headwaters, especially those that are already depleted.

Challenges

Challenges

- Providing adequate water supply to meet needs across sectors and geographic areas: This challenge encompasses the reality that water in Colorado is conveyed to meet local demand, which requires significant investment in infrastructure, operations, and maintenance. Funding at the scale needed secondary challenge.

- Protecting Colorado’s environment to maintain and improve our water resources: Colorado’s watersheds are impacted by the complex interactions of forest, wetland, and headwater stream health, along with models of managing water resources in ways that improve our water resources:

- Meeting Colorado’s interstate compact obligations while preserving supplies for future demand: Each of Colorado’s major rivers is subject to obligations imposed by interstate decrees or compacts. These compacts and decrees are unique in their application and context but in some cases may have implications for future water management.

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Colorado’s water law developed as settlers in the Colorado Territory learned the realities of Colorado’s semi-arid climate and snowmelt hydrology, and sought to establish stable communities and economies based on mining and agriculture. As the Colorado Supreme Court said in 2001, “The objective of the water law system is to guarantee security, assure reliability, and cultivate flexibility in the public and private use of this scarce and valuable resource.”

Our legal framework forms the backdrop and context for how we will address our shared water challenges.

Principles of Colorado Water Law

The foundation of Colorado’s water law is the “prior appropriation system,” which is the framework for establishing one water user’s priority over that of another. The framework was needed in the arid western United States to divert and transport water long distances from its source and protect older established water rights from new uses in times of shortage. This was a departure from the riparian water laws common in the eastern United States and Europe.

Projects and strategies for securing our water future must be consistent with:

- The Colorado Doctrine
- Colorado’s obligations to neighboring states
- Applicable federal, state, and local regulations

The prior appropriation system is to guarantee context for how we will address our shared water challenges.

WHAT PRIOR APPROPRIATION DOES REALLY WELL IS PROVIDE CERTAINTY… WE KNOW THAT WHEN THERE IS NOT ENOUGH WATER THOSE AT THE FRONT OF THE LINE GET THEIR WATER. THAT CREATES PREDICTABILITY AND CERTAINTY. HISTORICALLY, IT HAS ALSO PROVIDED OPPORTUNITY.

— TOM ROMERO, DU law professor
The Colorado Doctrine

in the 1860s with a set of principles known as the Colorado Doctrine:

• All surface and groundwater in Colorado are public resources for beneficial use by public agencies and private persons.
• A water right is a right to use a portion of the public's water resources—a "usufructuary" right.
• Water rights owners may build facilities on the lands of others, either by agreement or with just compensation, to divert, extract, or move water from a stream or aquifer to its place of use.
• Water rights owners may use streams and aquifers for the transportation and storage of water.

Beneficial Use

Beneficial use includes both the purpose for which water is diverted and efficiency of use. Diverted water must serve a purpose economically, socially, or hygienically. Recognized beneficial uses are defined by statute and have changed with public values. Historically, beneficial use focused on domestic and agricultural use, but today includes municipal, industrial, wildlife, recreational, and other uses. Beneficial use includes a notion of wise use, without waste.

WHERE TO FIND MORE INFORMATION

Colorado water law is a fascinating and deeply complex topic. Much has been written about its origins, evolution, principles, and application. Below are a few resources that provide more detailed information on Colorado's water law and administrative framework:

• 2015 Colorado Water Plan Section 2.1
• Citizen's Guide to Colorado Water Law - Water Education Colorado
• Synopsis of Colorado Water Law, Division of Colorado Water Resources
• Water Rights | Division of Water Resources

I THINK OUR GENERAL ASSEMBLY AND WATER USERS WILL CONTINUE TO DEVELOP DIFFERENT WAYS OF MANAGING AND OPTIMIZING OUR WATER ALL WITHIN THE PRIOR APPROPRIATION SYSTEM.

— KEVIN REIN, State Engineer, Colorado Division of Water Resources

ACEQUIAS IN COLORADO

perpendicular to the ditch systems to ensure that each

of land holding.

in Colorado. The oldest water right in Colorado is the

are fundamental to the historic Hispanic agricultural

Acequia Assistance Project – Getches-Wilkinson Center – For Natural Resources, Energy, And the Environment

Obligations to Neighboring States

### COMPACT OR DECREE

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<thead>
<tr>
<th>COMPACT OR DECREE</th>
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<tr>
<td><strong>EAST SLOPE</strong></td>
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<tr>
<td>Arkansas River Compact</td>
<td>Colorado, Kansas</td>
<td>Protected uses in place at time of the compact and allowed for future additional uses in Colorado and Kansas only to the extent that waters of the river are not “materially depleted.” It apportioned water of the Arkansas River to the states by way of specifying operations of John Martin Reservoir, rather than by assigning an allowable consumptive amount to each state or requiring a delivery amount from Colorado to Kansas. Established an interstate agency, the Arkansas River Compact Administration, to administer the compact, set operating procedures for John Martin Reservoir, and investigate compact violations.</td>
</tr>
<tr>
<td>Republican River Compact</td>
<td>Colorado, Nebraska, Kansas</td>
<td>Established an undepleted flow from all the tributaries within the basin and the main Republican River, based on a 10-year study period. Allocated consumptive use out of each tributary basin to the three states. Colorado was granted consumptive use of 54,100 acre-feet, split across the North Fork, Arickaree River, South Fork, and Beaver Creek subbasins. Provided for the allocations to be adjusted if the undepleted flow, at the subbasin level, turned out to be more than 10 percent different from those calculated at the time of the compact.</td>
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<td>South Platte River Compact</td>
<td>Colorado, Nebraska</td>
<td>Between April 1 and October 15, Colorado must deliver 120 cubic feet per second (cfs) at the Julesburg gage and is obligated to maintain the required flow by curtailing diversions junior to June 14, 1897, within Water District 64. There are no restrictions on Colorado’s use of South Platte River flows from October 15 through April 1.</td>
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<td><strong>NORTH SLOPE</strong></td>
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<td>Laramie River Decree</td>
<td>Colorado, Wyoming</td>
<td>This is not a compact but a Supreme Court order, which vacated earlier decrees (1922, 1940) and set forth the following apportionment of Laramie River waters: Colorado may divert 49,375 acre-feet of water from the Laramie River each calendar year, of which no more than 19,875 acre-feet may be for use outside the Laramie River basin, and no more than 1,800 acre-feet diverted for use within the basin may be diverted after July 31. Water used within the State of Colorado is limited to irrigation use as specified in the decree. There is no restriction on the type of use for water delivered outside the basin.</td>
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<tr>
<td>North Platte Decree</td>
<td>Colorado, Wyoming, Nebraska</td>
<td>This is not a compact but a stipulated settlement decree that replaces the original decree entered in 1945, as modified in 1953. The decree provides that Colorado may divert water from the North Platte River and its tributaries to irrigate up to 145,000 acres of lands in Jackson County. It also provides that Colorado may store up to 17,000 acre-feet annually for such irrigation purposes. The decree limits exports out of the basin to 60,000 acre-feet in any 10-year period. The decree does not limit Colorado’s use for domestic, municipal, and stock watering consumption, nor does it affect apportionment of the Laramie River Decree.</td>
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<tr>
<td>Compact or Decree</td>
<td>Parties</td>
<td>Description</td>
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<td><strong>Colorado River Compact</strong>&lt;br&gt;1922</td>
<td>Colorado, New Mexico, Utah, Wyoming, Arizona, California, Nevada</td>
<td>Established the Upper Basin (Colorado, New Mexico, Utah, and Wyoming) and the Lower Basin (Arizona, California, and Nevada). Each Basin is apportioned in perpetuity the exclusive beneficial consumptive use of 7.5 million acre-feet annually. The Compact requires the Upper Basin States to not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75 million acre-feet in any period of 10 consecutive years. The Compact also sets forth requirements for how the Upper and Lower Basins will meet any obligations to Mexico. The Compact affirmed the states’ authority to regulate appropriation, use, and distribution of water within their boundaries. The Compact is regarded as the cornerstone of the “Law of the River,” a body of compacts, decrees, and other legal documents concerning allocation, development, exportation, and management of the waters of the Colorado River.</td>
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<tr>
<td><strong>Upper Colorado River Compact</strong>&lt;br&gt;1948</td>
<td>Colorado, New Mexico, Wyoming, Utah</td>
<td>Allocates the Upper Basin’s 7.5 million acre-foot apportionment among the four Upper Basin States based on percentages of available water per year, and 50,000 acre-feet per year to the portion of Arizona that drains above Lees Ferry. The Upper Colorado River Basin Compact also created the Upper Colorado River Commission and, among other powers, authorized the Commission to make findings with respect to the necessity for and the extent of curtailment of use required, if any, pursuant to Article IV of the Upper Basin Compact. It also allocates consumptive uses of interstate tributaries in the Upper Division States (Little Snake River, Henry’s Fork River, Yampa River, and the San Juan River and its tributaries).</td>
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<tr>
<td><strong>Animas-La Plata Project Compact</strong>&lt;br&gt;1969</td>
<td>Colorado, New Mexico</td>
<td>Established that the right to divert and store water from the La Plata and Animas Rivers in either Colorado or New Mexico, for use in New Mexico, shall be of equal priority with rights granted by Colorado state courts for uses of Animas and La Plata River waters within Colorado. New Mexico’s use counts toward its allocation of water under the Upper Colorado River Compact. The two states entered this compact to move forward with the Animas-LaPlata Federal Reclamation Project.</td>
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<tr>
<td><strong>La Plata River Compact</strong>&lt;br&gt;1922</td>
<td>Colorado, New Mexico</td>
<td>Established two administrative gaging points, the La Plata River at Hesperus, Colorado, and the Interstate station, a stateline gage. The Hesperus gage is approximately 30 miles above the Interstate station. Both Colorado and New Mexico have unrestricted use of water from December 1 through February 15. During the rest of the year, if Interstate Station flows fall below 100 cfs, Colorado must deliver to the stateline half the amount of the Hesperus gage flow. For the purpose of the compact, the Hesperus flow is deemed to be the flow in the gage plus the sum of concurrent upstream diversions. Interstate Station flows are deemed to be the flows in the Interstate gage, plus half the concurrent diversions by the Enterprise and Pioneer Canals. These two diversions are in Colorado but serve approximately equal acreage in Colorado and New Mexico.</td>
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<td><strong>Rio Grande Compact</strong>&lt;br&gt;1938</td>
<td>Colorado, New Mexico, Texas</td>
<td>Colorado’s delivery obligation at the Lobatos gage near the state line varies each year depending on annual Rio Grande flows at Del Norte, where the river leaves the San Juan Mountains and enters the broad San Luis Valley, and the sum of annual Conejos River flows at the Mogote gage, plus Los Pinos River flows near Ortiz and San Antonio River flows at Ortiz from April to October. The higher the flow, the larger percentage of the flow Colorado must allow to flow past the state line with New Mexico. The Compact sets forth flexible accounting rules such that Colorado can accrue limited debits and credits. It can fall behind the obligation delivery or exceed the obligation delivery. This system of debits and credits is facilitated by the existence of Elephant Butte and Caballo Reservoirs in New Mexico. Because the annual obligation depends on the annual streamflow, the Division Engineer must forecast flows for the year and strive to curtail diversions at a level that will satisfy the Compact delivery without overdelivering.</td>
</tr>
<tr>
<td><strong>Costilla Creek Compact</strong>&lt;br&gt;1944, amended 1963</td>
<td>Colorado, New Mexico</td>
<td>Sets the amount of water to be delivered to users in Colorado and New Mexico based on water availability and lays out how to allocate surplus flows and storage in post-compact reservoirs. Usable capacity in Costilla Reservoir (in New Mexico) is allocated 36.5 percent to Colorado and 63.5 percent to New Mexico.</td>
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**WHERE TO FIND MORE INFORMATION**
- [Colorado Division of Water Resources: A Summary of Compacts and Litigation Governing Colorado’s Use of Interstate Streams](#)
- [Law & Policy | DNR CWCB](#)
- [Interstate Compacts | Division of Water Resources](#)
Water is the giver and sustainer of life. The Creator instilled in the First Peoples the responsibility of protecting the delicate, beautiful balance of Mother Earth for the benefit of all living creatures. Native American people embrace the stewardship of water and lead from a spiritual mandate to ensure that this sacred water will always be protected, available, and sufficient for cleansing, for growing and cooking food, and for sustaining native wildlife and plants.

“Water is life” is the basis of the vision of the Ten Tribes Partnership.

24 For more information, refer to Volume 2 Section 4 of the Technical Update
The Tribal federal reserved water rights have the potential to play an important role in not only addressing water management issues for the Tribes themselves, but also serving the greater interests of the community of Southwest Colorado. Furthermore, the special nature of Tribal water rights may provide opportunities in the future that other water rights do not allow. Both SUIT and UMUT are members of the Southwest Basin Roundtable and recognize the importance of planning for future water use in the Southwest Basin. To that end, each of the Tribal governments includes a Water Resources Division that provides for the management, conservation, and use of the Tribe's water resources, including strategic planning for the continuing development of water resources to benefit the Tribal membership. The UMUT Tribal Council formed a Water Resources Committee in 2021, with a primary goal of establishing a Water Resources Department that will assist the Tribal Council in managing and developing their water resources. Building the capacity to develop a UMUT Water Resources Department is included in the Project Database.

In addition to the Tribal federal reserved water rights, both Tribes also have “non-reserved” water rights within the Colorado water rights system. The UMUT owns four ranches with non-reserved water rights in the Southwest Basin and the Pinecrest Ranch and associated water rights in the Gunnison Basin. The continued beneficial use, development, and diligence of the water rights on the four ranches will also be explored as part of the UMUT Water Rights Options Study, and specific projects related to the ranches will be included in future Project Database updates.

The SUIT and UMUT are part of the Ten Tribes Partnership, a coalition of Colorado River basin Tribes that have come together to claim their seat at the table and raise their voices in the management of the Colorado River. Water is sacred to the Colorado River Tribes. It is good to reach out to each Tribe. They too will become partners for the future and for how we are going to move forward through this drought. Whether it is environmental, agricultural water, or recreation or municipal or industrial, all of these areas are priorities for Tribes that are part of the Colorado River Basin.

— Manuel Heart, Chairman, Ute Mountain Ute Tribe
Recent Developments in Law and Administration


Agricultural Water Protection Water Right.

Anti-speculation workgroup.


Formation of Subdistricts in the Rio Grande Basin.

Republican River Compact Compliance.

Colorado River Issues and Developments.

Stormwater Detention and Water Rights.
COLORADO RIVER ISSUES AND DEVELOPMENTS

Drought Contingency Planning

In 2019, the seven Colorado River Basin states completed and signed drought contingency plans (DCP) for the Upper and Lower Basins. The DCP is designed to help stabilize the Colorado River system and to reduce the risk of Colorado River reservoirs declining to critically low levels.

The DCP will expire at the end of 2025.

UPPER BASIN DCP

Upper Basin DCP measures include:

- **Drought Response Operations Agreement (DROA):**
  - Purpose: To protect critical target elevations at Lake Powell.
  - Contemplates potential operational adjustments to the timing and volume of water released from Glen Canyon Dam. It also contemplates releases from Flaming Gorge, Aspinall Unit, and Navajo Reservoirs. The DROA further provides for recovery of any released storage water in subsequent years.

- **Demand Management Storage Agreement:**
  - Authorizes the Upper Division States to store up to 500,000 acre-feet of additional water in Colorado River Storage Project reservoirs that can only be released for the purpose of assisting the Upper Division States in maintaining compliance with the Colorado River Compact. Such water would be created through an Upper Basin Demand Management Program, which would involve temporary, voluntary, compensated reductions in consumptive use in the Upper Basin. All Upper Division States must agree such a program would be feasible to establish a program before one may be set up. All Upper Division States, including Colorado, are currently conducting feasibility investigations.

- **Weather Modification:**
  - Continued use of cloud seeding across Utah, Colorado, and Wyoming to augment snowpack.

LOWER BASIN DCP

Lower Basin DCP measures include:

- **Tiered reductions to water deliveries to Lower Basin States and Mexico based on predetermined Lake Mead elevations.**
- **Incentives and provision of storage for additional conservation of Colorado River water supplies.**

Lower Basin shortages were declared by BOR for the first time starting in 2022.

[Link for more information: Colorado River Basin | DNR CWCB]
Post-2026 Reservoir Operations

In response to several years of prolonged drought in the Colorado River Basin and depleted storage levels in Lake Powell and Lake Mead, the 2007 Guidelines were developed to coordinate operations of the two reservoirs and define shortage criteria for the Lower Division States. These guidelines will expire at the end of 2025 and efforts are underway to determine what will come next for post-2026 operations at Lake Powell and Lake Mead. Colorado is represented by the governor appointee to the Upper Colorado River Commission in these interstate discussions.

Measurement Rules

A measurement rulemaking process is underway to establish standards for accurate measurement and reporting of diverted or stored water.

Transmountain Diversions

Also known as transbasin diversions, these projects divert water across watershed boundaries. In Colorado, 27 diversions transport approximately 580,000 acre-feet of water annually from one of the state’s four major river basins to another. Historically these diversions have helped Colorado make the most of its Colorado River allocation by moving it around the state and putting available water to beneficial use. However, these projects have not been without basin-of-origin impacts, which continue to be considered today.

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**ADDITIONAL DEVELOPMENTS THAT INFORM THE WATER PLAN**

Since the 2015 Water Plan, a wide variety of legislation, funding programs, and work groups were initiated that were either a result of the 2015 Water Plan or that inform the vision and actions that are included in the Water Plan update (see Chapter 6). This timeline depicts these items and events. CWCB led or contributed to nearly all of the items on the timeline, and it illustrates CWCB’s continual engagement with partnering agencies and stakeholder groups in efforts to implement the Water Plan.

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**2015**

- **Advancing Direct Potable Reuse (DPR)**
  - DPR featured prominently in the first Water Plan and several CWCB funded projects have centered on it since 2015.

- **Colorado Water Loss Initiative**
  - This program is part of a strategic objective from the Colorado Water Plan: to support water management activities for all water providers.

- **Priority Environmental and Recreational Rivers and Watersheds**
  - The priority rivers and watersheds, or “Focus Area maps,” were developed by each basin to serve as a snapshot of baseline conditions.

- **Stream Management Plans and Integrated Water Management Plans**
  - SMPs and IWMPs encourage effective project implementation and on-the-ground actions.

**2016**

- **Passage of HB 16-1005**
  - The “rain barrel bill,” passed in 2016, allowed single-family residences to install two rain barrels up to 110 gallons total.

- **Implementation of SB 14-103**
  - Requires that only low-flow EPA WaterSense approved indoor fixtures can be sold.

**2017**

- **Colorado Growing Water Smart**
  - A joint program of the Sonoran Institute and Lincoln Institute of Land Policy brought Growing Water Smart workshops to Colorado.

- **Formation of the Water and Land Use Planning Alliance**
  - CWCB and the Colorado Department of Local Affairs (DOLA) formed the Alliance in December 2017. The group emerged from another project, the Colorado Water and Growth Dialogue, with the core group of people forming the Alliance.

- **Water Plan Grants**
  - In 2017, Colorado’s General Assembly first made funds available for CWCB to help implement the Water Plan through its grant programs.

- **Inter-agency Lean Permitting Handbook**
  - The Colorado Water Supply Planning and Permitting handbook was developed in 2017 to foster more efficient water project permitting.

**2018**

- **Regulation 84 Expansion**
  - Eighteen additional uses for recycled water were approved, including irrigation uses for edible crops and industrial hemp.

- **Ten Tribes Water Study**
  - The Ten Tribes Partnership Tribal Water Study was released.

- **Implementation Working Group**
  - The CWCB initiated BIP updates by launching an Implementation Working Group to develop guidance.
Ongoing

**State Financial Assistance**
Various forms of financial assistance are available to support multi-benefit irrigation infrastructure and water conservation projects.

**Population Growth/Declining Use**
Colorado’s population continues to grow, but per capita use has declined due to municipal water conservation efforts.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>Proposition DD&lt;br&gt;Colorado voters approved Proposition DD, taxing legal sports betting to support projects that align with the Water Plan.</td>
</tr>
<tr>
<td>2020</td>
<td>Passage of HB 20-1095&lt;br&gt;This bill requires local jurisdictions to incorporate water efficiency into their comprehensive plan if their plan contains a water element.</td>
</tr>
<tr>
<td>2021</td>
<td>Forest Health&lt;br&gt;“State of the Science”&lt;br&gt;The Forest Health Study is an assessment of the state of the science around watershed and forest-health-related issues that impact water quality and water quantity.</td>
</tr>
<tr>
<td>2022</td>
<td>Passage of SB 22-028&lt;br&gt;Provides $60 million to incentivize the purchase and retirement of irrigated acreage in the Republican and Rio Grande Basins.</td>
</tr>
</tbody>
</table>

**Technical Update Released**
The Technical Update included updated analyses and tools that support the Water Plan.

**Passage of HB 19-1231**
This bill added requirements for energy and water efficiency for fixtures and appliances sold in Colorado.

**Adoption of Updated Colorado Resiliency Framework**
DOLA updated the Colorado Resiliency Framework in 2020, which includes partnerships with CWCB.

**Expansion of Colorado Department of Agriculture Programming**
The 2020 legislative session provided several beneficial programs for the Colorado Department of Agriculture.

**ATM Status Update**
A report called Alternative Transfer Methods (ATM) in Colorado, Status Update was released in July 2020.

**Fluvial Hazard Zone Program**
This technical tool helps communities identify, map, and plan for natural hazards such as erosions, sediment deposition, and other dynamic river processes.

**Natural Working Lands Task Force**
The state’s Natural Working Lands Task Force was formed.

**Passage of SB 22-158**
Provides $6 million for conservation programs designed to protect threatened or endangered native species.

**Basin Implementation Plans**
Eight BIPs developed by basin roundtables and the online Project Database was released.

**New Direct Potable Reuse Regulations Adopted**
Water Quality Control Commission added new DPR rules to Colorado Primary Drinking Water Regulation 11.
CWCB’S Water Leadership

The State of Colorado’s Executive, Legislative, and Judicial Branches all play pivotal roles in supporting Colorado’s water future. The CWCB, as part of the Executive Branch under DNR, maintains and implements the Colorado Water Plan. Through several funding mechanisms, including Colorado Water Plan grants, CWCB is able to support many of the projects Colorado needs to fulfill the vision of the Water Plan.

Water management in Colorado is complex and includes many stakeholders, including regulatory agencies, quasi-governmental organizations, water providers, ditch companies, constitutionally mandated boards, and nongovernmental organizations, which play significant roles in water-related initiatives and projects. Similarly, joint partnerships with universities, regional entities, commissions, Tribes, and federal partners all support many water-related issues in Colorado. Many of these groups work with CWCB to coordinate the management of water in the state. CWCB’s role in convening and collaborating across groups allows it to play a lead role in state water policy.

CWCB’s Policy and Programmatic Leadership

As the primary state agency charged with maintaining and implementing the Colorado Water Plan, all of CWCB’s programs and activities reflect this important goal. Its mission is to conserve, develop, protect, and manage Colorado’s water for present and future generations.

CWCB Funding, Grants and Loans

Funding local water projects is one of CWCB’s most important functions. The CWCB’s fund portfolio includes the Construction Fund, Severance Tax Perpetual Base Fund, and the Water Plan Implementation Cash Fund. Revenue for these funds comes from a combination of revolving loan fund principal and interest, State treasury interest, Federal Mineral Lease revenue, severance tax revenue, and sports betting taxes. These sources of revenue allow CWCB, with legislative and board direction, to fund low-interest loans and grants for projects that advance and implement aspects of the Colorado Water Plan. The CWCB also receives revenue from other sources, including interest from loans it provides, which is the primary source of funding for CWCB to manage its programs, staff, and grants.

The primary CWCB grant programs are Water Supply Reserve Fund grants, which are administered through the basin roundtables; Public Education Participation and Outreach (PEPO) grants, which support a dedicated liaison for each roundtable to support education and outreach efforts; and Colorado Water Plan grants. A full list of CWCB grant and loan program information can be found on CWCB’s funding web page, and an overview of the types of funded projects are listed here:

**EXAMPLE CWCB GRANT PROJECT TYPES**

- New water storage, raw water supply, planning, water conservation, and agricultural projects; collaborative water sharing agreements; watershed and recreation projects; water education and innovation.

**EXAMPLE CWCB LOAN PROJECT TYPES**

- New or rehabilitation of aging and existing raw water storage and delivery facilities.

* Many of the grant categories and the types of projects they can fund are defined by legislation.
Chapter 3: State Context

Funding From Other State Agencies

Colorado’s approximately 200 state agencies provide many additional grant and loan programs that cover a wide range of needs. While CWCB primarily focuses on raw water, other groups like CDPHE can fund drinking water improvements. Many groups do not focus on water but can support water in indirect ways (e.g., Colorado State Forest Service, Colorado Outdoor Recreation Industry Office).

The Colorado Water Plan Grant Program was developed to make progress on implementing the objectives of the 2015 Water Plan. This and other grant programs are a way that CWCB works with partners and stakeholders across the state to implement projects that advance the Water Plan. From 2021 to 2022, CWCB streamlined and consolidated many of its grant programs into Colorado Water Plan grants. The legislature described the types of projects to be funded with Colorado Water Plan grants as:

- Water storage and supply: Includes development of additional storage, artificial recharge into aquifers, and dredging existing reservoirs to restore the reservoirs’ full decreed storage capacity for multi-beneficial projects, collaborative water sharing agreements, and projects identified in BIPs to address the water supply and demand gap.
- Conservation and land use planning: Includes long-term strategies for conservation, land use, water efficiency, reuse, and drought planning.
- Engagement and innovation: Includes water education, outreach, and innovation efforts.
- Agricultural projects: Includes technical assistance or project/program funding for agricultural projects.
- Watershed health and recreation projects: Includes projects that promote watershed and environmental health and recreation.

Chapter 6 provides numerous examples of projects that partners and stakeholders can pursue within the categories listed above that align with and implement the vision of the Colorado Water Plan.

Other Funding Sources

SOURCES THAT SUPPORT CWCB

- Special Legislative Appropriations: In any year the legislature may appropriate funds outside of the annual Projects Bill. These are often provided to fund special programs or projects.
- State Stimulus Funding: One-time General Fund investments when monies are available and allocated through the legislature.
- State Ballot Measures: State ballot measures that go to the voters can provide additional funding to agencies. For example, in 2019, Proposition DD legalized sports betting and generated tax revenue to support water projects.

SOURCES OUTSIDE OF CWCB

- Local Ballot Measures: Since 1998, local water districts and counties have approved several ballot measures to fund conservation, water education, stream health, storage, and agriculture.
- State Stimulus: One-time General Fund investments when monies are available and allocated through the legislature.

OTHER FUNDING INITIATIVES

Many times, these additional funding sources can be leveraged for match funds or could otherwise augment money CWCB can provide. These include things like:

- Local Ballot Measures: Local initiatives can provide additional funds.
- State Stimulus: State initiatives can provide additional funds.

Funding From Other State Agencies

Colorado’s approximately 200 state agencies provide many additional grant and loan programs that cover a wide range of needs. While CWCB primarily focuses on raw water, other groups like CDPHE can fund drinking water improvements. Many groups do not focus on water but can support water in indirect ways (e.g., Colorado State Forest Service, Colorado Outdoor Recreation Industry Office).
Colorado Water Conservation Board

The estimated costs of
- Frequently issued by water providers to raise funds for capital projects.
- These include bills such as:

Given all these
- A revenue bond that shifts risk to private investors that can be effective in maximizing water

Colorado’s Water Pollution Control Revolving Fund and the Drinking Water Revolving Fund

OTHER FUNDING TOOLS

- Revenue Bonds
- Environmental Impact Bonds
- State Revolving Fund Loans

State Revolving Fund Loans offer low-cost loans to public water providers for water supply and water pollution control infrastructure projects.

Environmental Impact Bonds

- that includes direct funding for drinking

American Rescue Plan Act (ARPA).

Infrastructure Investment and Jobs Act (IIJA) or Bipartisan Infrastructure Law (BIL) – that includes direct funding for drinking

Inflation Reduction Act

COLORADO WATER FUNDING NEEDS

Background:

This leaves an expected Water Plan funding gap of $1.5 billion, approximately $50 million per year through 2050, that CWCB would need to meet the identified project demands.

While the $1.5 billion in needed funding represents CWCB’s funding gap there are other state needs

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2022 BIP Update Information:

In the 2015 Water Plan, a summary of basin

Funding sources are sustained at their expected levels.

In the 2015 Water Plan, a summary of basin

However, some of this need will be met through rates,

2022 BIP Update Information:

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Anticipated CWCB Funding Needs:

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Chapter 3: State Context

Projects supported by state funding do not always imply the project is endorsed by the State.

FRAMEWORK FOR STATE OF COLORADO SUPPORT FOR WATER PROJECTS

The statute that guides CWCB as it pertains to adopting and updating the State Water Plan also created the Water Plan Implementation Grant Program (37-60-106.3 (6), C.R.S.). This legislation articulates a set of criteria the CWCB Board shall evaluate for each eligible project grant application. The criteria are also reflected in CWCB’s Colorado Water Plan grant criteria and guidelines, including considering alignment with: a) applicable BIPs; b) the anticipated start date; c) gives preference to projects that have multiple benefits, multiple purposes, and involve multiple stakeholders; and d) references additional criteria for state support from the 2015 Water Plan, which are described below.

Since 2015, the State has also created The Colorado Water Supply and Permitting Handbook. The handbook should be considered as the starting point for project proponents that need to know what permitting is required. The handbook includes a discussion of an array of permitting, licensing, review, certification, and mitigation plans. Collectively, the Water Plan grant criteria, the criteria for state support, and the handbook stand as the guiding documents for ensuring projects conform with the intent of the Water Plan, legislation, and any required permitting.

For a project to be eligible for State of Colorado support, any required permitting or similar approval must be secured or appropriately contemplated in a project grant application or other request for support. Certain water project proponents are expected to engage in developing state fish and wildlife mitigation plans, when required by statute. However, not all projects will require permitting. Those that do should invest in pre-permitting work (e.g., initial studies, stakeholder involvement, engaging state agencies) to ensure the success of the project.

PRE-PERMITTING WORK (INITIAL STUDIES AND STAKEHOLDER INVOLVEMENT)

If a project proponent is seeking state technical or financial support for initial planning, baseline environmental studies, alternatives analysis, feasibility studies, or initial stakeholder involvement, priority will be given to projects that meet the goals of the BIPs, have an identified project proponent, meet an identified need, and have a defined start time (e.g., can be built within the next 15 years).

STATE SUPPORT FOR PROJECTS ALIGNED WITH COLORADO’S WATER VALUES

A project proponent can voluntarily qualify for state support in the form of state engagement, facilitation, or funding (e.g., grants, loans, special funding) by ensuring the project aligns with Colorado’s water values (see Chapter 1) and the overall Water Plan. The State adopts the criteria from the 2015 Water Plan by reference, as found in the linked document below, as the criteria for determining alignment with the Water Plan. The criteria are summarized as follows:

- The project proponent demonstrates a commitment to collaboration that includes multiple participants and project impacts that have the ability to provide multiple benefits, and multipurpose project development.
- The project proponent addresses an identified water gap, risk, or need identified in the Water Plan, Technical Update, and/or a BIP.
- The project proponent demonstrates sustainability as it pertains to environmental and recreational interests, water conservation, water quality, economic and social impacts, maximizing beneficial use, partnerships with local government, and conforms with water law.
- The project proponent establishes the fiscal and technical feasibility of the project including the total cost and local investment or contribution.

Link for more information about advancements on efficient permitting and state support for projects found here.

*Projects supported by state funding do not always imply the project is endorsed by the State.
The CWCB Organization

Finance - DVP
Manages programming related to interstate resources for water users and stakeholders.

• DVP

Stream and Lake Protection

The CWCB partners with federal, state, and local partners on many watershed protection initiatives, including those related to flood, fire, and drought. This includes work with Homeland Security and Emergency Management, the State Forester, and other partners on issues such as endangered species recovery programs, approaches to water management (i.e., compacts, negotiations, and other matters).

Water Supply Planning

The CWCB, like all state agencies, plays a role in supporting EDI. dZ

Watershed and Flood Protection

The CWCB partners with federal, state, and local partners on many watershed protection initiatives, including those related to flood, fire, and drought. This includes work with Homeland Security and Emergency Management, the State Forester, and other partners on issues such as endangered species recovery programs, approaches to water management (i.e., compacts, negotiations, and other matters).

Beginning in 2023 the Water Plan Grant Program was awarded funds to support four regional project managers that would live and work in each of the following regions: South and North Platte basins, the Arkansas Basin, the Southwest and Rio Grande, and the Colorado, Gunnison, and Yampa-White-Green basins. These regional coordinators will provide local capacity-building through coordination and planning with stakeholders for project identification, grant writing, and evaluating grant applications.
Water Resources Partnerships

Water development projects require collaboration and coordination. Water development occurs under multiple agencies' jurisdictions depending on geography and nature of the development. Those that wish to implement a water project in Colorado must have permits, licenses, contracts, certifications, or other approvals from numerous local, state, and federal governmental entities. Partnerships with and among agencies at all levels of government are critical to ensure that the State can identify and address environmental issues in a timely and effective manner. Partnerships among water users and agencies can be beneficial in creating multi-benefit projects that leverage several sources of funding. In addition to federal, state, and local partnerships, Colorado recognizes the importance of engaging with Tribal Nations as fellow sovereigns and partners in managing water resources for the benefit of all users. This section provides an overview of the entities typically involved in permitting and funding, and the State's role in planning.

FEDERAL

The United States Department of Agriculture (USDA)/Natural Resources Conservation Service (NRCS) provides farmers and ranchers with financial and technical assistance to implement conservation practices and projects, including water conservation.

The United States Environmental Protection Agency comments on NEPA documents and reviews the USACE's Clean Water Act 404 permits.

The Federal Energy Regulatory Commission (FERC) is responsible for licensing non-federal hydropower projects.

The United States Fish and Wildlife Service (USFWS) regulates actions affecting threatened or endangered species listed under the Endangered Species Act (ESA). This agency is responsible for determining whether a project exceeds the bounds of any programmatic biological opinions regarding further water development. In addition, under the Fish and Wildlife Coordination Act, federal agencies responsible for coordinating federal NEPA compliance must consult with the USFWS regarding a project's potential effects on threatened and endangered fish and wildlife species.

The United States Army Corps of Engineers (USACE) is responsible for Clean Water Act (CWA) Section 404 permitting related to placing dredged or fill material in U.S. waters, including jurisdictional wetlands. It is also responsible for approving the use of federally owned flood control and water supply facilities.

The United States Bureau of Reclamation built and now manages several water supply and hydropower projects. In Colorado, these include Blue Mesa Reservoir, the Fryingpan-Arkansas Project, and the Closed Basin Project. The BOR is responsible for contracting water out of these federal projects, and these federally owned facilities.

The United States Forest Service (USFS) manages national forests and grasslands and has substantial land holdings in Colorado. The USFS assumes the lead agency role under NEPA.

The United States Bureau of Land Management (BLM) manages substantial public-land holdings within Colorado and assumes the lead agency role under NEPA in certain situations.

The United States National Park Service (NPS) manages substantial land holdings within Colorado for national parks, monuments, recreation areas, and historic sites. The NPS assumes the lead agency role under NEPA in certain situations.

The United States Fish and Wildlife Service (USFWS) regulates endangered species listed under the Endangered Species Act (ESA). This agency is responsible for determining whether a project exceeds the bounds of any programmatic biological opinions regarding further water development. In addition, under the Fish and Wildlife Coordination Act, federal agencies responsible for coordinating federal NEPA compliance must consult with the USFWS regarding a project's potential effects on threatened and endangered fish and wildlife species.
The CWCB is the primary state agency responsible for statewide water planning. Water planning determines the types of water projects and quantity of water needed to support Colorado's growing population. Other state agencies and supporting, constitutionally-established organizations have a critical role in planning, participating in permitting processes, water administration, and other water-related aspects of project development.

The Colorado Water Quality Control Division (WQCD) is housed within CDPHE and monitors and reports on the state of the state's water quality. The agency reviews water quality certifications under Section 401 of the CWA and regulates water quality throughout the state.

The CWCB is a division within the Colorado DNR. The CWCB helps protect and develop the waters of the state, sets water policy and planning through the Water Plan, and has a role in funding project studies and implementation.

The Division of Water Resources is housed within the Colorado Department of Agriculture (CDA) and is responsible for managing water resources throughout the state. The division is responsible for maintaining the Water Plan, which sets goals for water use and development.

Great Outdoors Colorado (GOCO) is a state agency that uses State lottery proceeds to help fund conservation and recreation projects, many of which impact water.

Colorado Outdoor Recreation Industry Office (OREC) provides a central point of contact, advocacy, and resources at the state level for the diverse constituents, businesses, and communities that rely on the continued health of the outdoor recreation economy. The office works to promote outdoor recreation activities and related businesses in Colorado.

Colorado DOLA is a state agency that coordinates on many planning programs with CWCB, including the Colorado Outdoor Recreation Industry Office (OREC) and the Great Outdoors Colorado (GOCO) program. DOLA also maintains stream and diversion measurement data to support water administration.

The Colorado Water Resources and Power Development Authority (CWRPDA) is a quasi-governmental agency that provides state and federal funding in the form of loans and grants to Colorado governmental agencies to finance water, wastewater, hydropower, and forest health infrastructure projects.

Water Quality Control Commission (WQCC) is the administrative agency responsible for developing specific water quality policy in Colorado. In addition to the Colorado Primary Drinking Water Regulations and other federal requirements, CDPHE provides additional details on actions it will take in WQCC Policy 98-2, "A Guide to Colorado Programs for Water Quality Management and Safe Drinking Water.”

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26 In addition to the Colorado Primary Drinking Water Regulations and other federal requirements, CDPHE provides additional details on actions it will take in WQCC Policy 98-2, “A Guide to Colorado Programs for Water Quality Management and Safe Drinking Water.”
**Chapter 3: State Context**

Colorado's local governments have considerable authority in making water development and management decisions. Colorado's counties and municipalities exercise a broad range of powers, which state law explicitly delegates to them, to address the needs of respective constituents. Generally, counties have discretionary powers to provide services, including water and sewer, and to operate districts for irrigation and recreation, among other uses.

In 1974, the Colorado General Assembly enacted HB 74-1041 that established "1041 powers," which allow local governments to maintain control over development projects. Development may only proceed if it is consistent with the local communities' environmental and developmental goals as outlined in their 1041 regulations, and a permit for a specific water project that does not meet the standards of the local regulations may be denied.

Furthermore, the State constitution authorizes municipalities and counties to adopt home-rule charters, which provide even greater autonomy and flexibility to address local problems. State law also provides local governments with authority specific to land use and water planning.

Colorado law allows voters to create many types of local special districts, which are governing entities that oversee specific services, such as fire protection, water, and sewer. Special districts related to water use and planning include:

<table>
<thead>
<tr>
<th>Water Districts: Supply water for domestic and other public and private purposes and provide reservoirs, treatment works, and facilities.</th>
<th>Metropolitan Districts: Including parks and water.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanitation Districts: Provide for storm and/or sanitary sewers, flood and surface drainage, treatment and disposal works and facilities, solid waste disposal facilities or waste services, and equipment.</td>
<td>Drainage and Flood Control: Surface drainage, treatment and disposal works and facilities.</td>
</tr>
<tr>
<td>Conservation Districts: Administer groundwater within the districts.</td>
<td>Irrigation Districts: Drainage work necessary to administer groundwater within the districts.</td>
</tr>
<tr>
<td>Groundwater Management Districts: Administer groundwater within the districts.</td>
<td>Park and Recreation Districts: Provide park and recreational facilities and programs.</td>
</tr>
</tbody>
</table>

Where to find more information on 1041 powers:
2015 Colorado Water Plan Section 9.1 and 9.4

[Link for 1041 Regulations in Colorado | Department of Local Affairs](#)
State Plans Vary in Scope but Often Intersect

State plans vary in scope but often intersect. Many State agencies have their own plans that focus on or touch water, but their plans may focus broadly or more specifically on an agency's internal goals and needs. The Water Plan's relationship to other agencies' plans is complementary. The Water Plan must work in conjunction with other agencies' plans to help them achieve their goals without getting in their way. The same is true for how other agencies work with the Water Plan. Strong collaboration is needed among agencies and stakeholders to achieve this.

Examples of State Plans in Comparison to the Water Plan

<table>
<thead>
<tr>
<th>PLAN CHARACTERISTICS</th>
<th>COLORADO WATER PLAN</th>
<th>RESILIENCY FRAMEWORK</th>
<th>NATURAL WORKING LANDS STRATEGY</th>
<th>CPW 2019 STRATEGIC PLAN</th>
<th>CDPHE WQCC POLICY 9B-2</th>
<th>COLORADO FOREST ACTION PLAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informed by an agency's capacity</td>
<td>●</td>
<td>●</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Promotes local action to achieve a vision</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identifies cross-agency actions</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Includes water topics</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Grants are central to implementation</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead agency can regulate</td>
<td></td>
<td>●</td>
<td></td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead agency constructs projects</td>
<td></td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
<td></td>
</tr>
</tbody>
</table>


CHAPTER 4

BASIN CONTEXT
Irrigation ditch. Photo credit: Rio de la Vista
Chapter 4: Basin Context

The Colorado Water Plan is supported by the collaborative framework created in 2005 through the Colorado Water for the 21st Century Act (HB 05-1177). The Act established two stakeholder groups that focus on local and statewide water issues:

- The CWCB directors and staff play a significant role in supporting these grassroots groups and local project development in several ways. The CWCB manages the Water Supply Reserve Fund (WSRF) and coordinates with roundtables as they recommend and advance WSRF grants to the CWCB for board approval and/or provide letters of support for Colorado Water Plan grants (see Chapter 3). The CWCB also provides targeted logistical support, coordination, and funding for basin roundtable meetings as well as providing funds for basin recorders to help maintain compliance with open meetings laws. Staff coordinate cross-basin discussions with basin roundtable chairs, PEPO, IBCC and, at times, larger statewide events that bring together all these stakeholders. Additionally, CWCB funds IBCC and its meetings, supports the IBCC chair, and helps facilitate IBCC discussions and initiatives.

- The grassroots approach of the basin roundtables, IBCC, and PEPO, which annually engages hundreds of stakeholders across diverse sectors and regions, enables residents in each basin to share their vision for Colorado's water future. The process produces informed discussions, provides a forum for building consensus, generates momentum for Colorado water planning and education, and supports local water project development.

This chapter provides a snapshot of each roundtable's BIP, describes common BIP themes, and summarizes basin-identified projects for meeting future water needs.

Basin Roundtables

Nine basin roundtables were established to collaborate on basin-specific issues.

- Interbasin Compact Committee
  The IBCC, which includes representatives from basins across the state, was created to facilitate interbasin discussions and negotiations between roundtables.

- Public Education, Participation, and Outreach Working Group
  Originally noted in HB 05-1177 as a working group of IBCC, the PEPO work group focuses on water-related education and outreach, and it has expanded to include members of IBCC, liaisons from each basin roundtable, and educators.

- Basin Roundtables
  Basin Roundtables

  Basin Roundtables
  Basin Roundtables

  Basin Roundtables
  Basin Roundtables

  Basin Roundtables
  Basin Roundtables

  Basin Roundtables
**Basin Roundtables**

The nine basin roundtables represent each of the state’s eight major river basins and the Denver metropolitan area. They are comprised of volunteers who represent a wide range of water-related perspectives, including municipal, environmental, agricultural, recreational, and industrial interests. The roundtables provide a forum for stakeholders to discuss water issues and find collaborative solutions. Another important function of the roundtables is to encourage and foster projects that help meet current and future water needs across all sectors of water use.

**Interbasin Compact Committee**

The IBCC provides an important, diverse, and balanced forum for policy input across Colorado and has helped shape statewide strategies for meeting potential water gaps, created the planning scenarios that were used as the basis for the Technical Update, and negotiated guidance on future transmountain diversion (TMD) projects (also known as the Conceptual Framework. See next page for a description). Recently, IBCC worked to develop stronger communication links among PEPO, the roundtables, and IBCC.

In 2014, the basin roundtables produced the first drafts of their BIPs. Through the basin roundtable process, representatives from the business community, local government, and water users, as well as stakeholders representing the environment, agriculture, recreation, and various industries, contributed to each BIP. The BIPs from the nine basin roundtables provided foundational information to the first Colorado Water Plan, which was published in 2015. In 2022, the basin roundtables finalized updates to their BIPs, which are summarized in this chapter.

> “The Interbasin Compact Committee has served many specific roles over the years, but most broadly, has stood as a united think tank to bring the self-interests of basins and stakeholders back to the statewide lens—where most of our self-interests are in fact common to the great state of Colorado.”
> — John Stulp, 2017 IBCC Annual Report
Chapter 4: Basin Context

Public Education, Participation, and Outreach

The PEPO Workgroup helps:

- Create a process to inform, involve, and educate the public on IBCC activities and progress
- Create a mechanism by which public input and feedback can be relayed to IBCC
- Educate IBCC and basin roundtable members about water issues

The PEPO workgroup members update with information from basins' PEPO liaisons—the basin-specific person, people, and/or contractor which some basins have developed to support local engagement. The PEPO workgroup also helps support and inform larger conversations with basin PEPO liaisons and other members of the water education community. The latter includes working with groups like Water Education Colorado, Colorado Watershed Assembly, and the Colorado Water Center.

Roundtables that have developed education and outreach committees work with PEPO liaisons to develop annual plans for outreach, education, and engagement in their basins.

Since the publication of the 2015 Water Plan, PEPO funding has increased to up to $300,000 annually across the state through PEPO grant funding that was created in 2021. Each year, basins are eligible for grant funding for a coordinator, and there are also limited funds available for working with CWCB on statewide initiatives around education and outreach that help support collaborative engagement across basins and shared education resources.

Link for more information on IBCC Public Education, Participation & Outreach Workgroup | DNR CWCB

COLORADO'S CONCEPTUAL FRAMEWORK

Prior to the 2015 Water Plan, Front Range roundtables identified a need for a balanced program to preserve options for future development of Colorado River water, while western slope roundtables expressed great concern regarding additional development of Colorado River water involving a new TMD. The Colorado Conceptual Framework seeks a path forward that considers the option of developing a new TMD and addresses the concerns of basin roundtables, stakeholders, and environmental groups. It represents consensus from IBCC to address both Front Range and western slope concerns about a TMD. The framework presents seven principles to guide future negotiations among proponents of a new TMD, if it were to be built, and the communities it would affect. The principles identify areas of statewide concern and state the issues and realities proponents of a new TMD should expect to address. Below are the seven guiding principles:

1. **Conceptual Framework Principles**
   1. **Eastern slope water providers are not looking for firm yield from a new TMD and the project proponent would accept hydrological risk for Z diversion.**
   2. **A new TMD would be used conjunctively with eastern slope supplies, such as interruptible supply agreement, Denver Basin Aquifer resources, carry-over storage, terminal storage, drought restriction savings, and other non-western slope water sources.**
   3. **To manage when a new TMD would be able to divert, triggers are needed.**
   4. **A collaborative program that protects against involuntary curtailment is needed for existing uses and some reasonable increment of future development in the Colorado River System, but it will not cover a new TMD.**
   5. **Future western slope needs should be accommodated as part of a new TMD project.**
   6. **Colorado will continue its commitment to improve conservation and reuse.**
   7. **Environmental resiliency and recreational needs must be addressed both before and conjunctively with a new TMD.**

Link for more information on Colorado's Conceptual Framework: waterinfo.org | Conceptual Framework
The Arkansas Basin is the largest basin in Colorado. Its varying landscape—from forest to grasslands—supports a mix of agriculture, mining, and recreational opportunities.

KEY ACHIEVEMENTS
Project successes helped local communities while improving local water resources and the environment. Successes include:

- Arkansas River Watershed Collaborative
- Monarch Pass Forest and Watershed Health Project
- John Martin Reservoir Permanent Conservation Pool
- Arkansas River Homestake Diversion Rehabilitation
- Arkansas Lease-Fallowing Tool
Base Overview

The Arkansas River is a major tributary to the Mississippi River, originating in the central mountains of Colorado near Leadville. Elevations in the headwaters reach more than 14,000 feet. The river first flows south through a relatively narrow valley to the town of Salida where it enters Bighorn Sheep Canyon. Continuing in a southeasterly direction, it enters the Great Plains near Pueblo. From Pueblo, the basin widens significantly, extending as much as 150 miles north to south as the river travels east to the Kansas state line. Its southside tributaries gather water from the east side of the high Sangre de Cristo Mountains, and northside tributaries drain the High Plains to the north. Elevation of the river as it leaves Colorado is approximately 3,300 feet. The Arkansas Basin within Colorado is the largest basin in the state, covering more than a quarter of Colorado.

Base Overview Facts

- At the Arkansas River's headwaters, annual precipitation ranges from 25 to 60 inches per year, most of which occurs as snow. Middle elevations receive between 15 and 25 inches of precipitation per year, which decreases to 8 and 12 inches in the lower basin.
- TMDs provide an important supply of water to the Arkansas Basin, and much of this water can be reused to extinction.
- The upper Arkansas River, from the headwaters through Bighorn Sheep Canyon, supports significant tourism and outdoor recreation. A 102-mile reach of the river is designated as a Gold Medal fishery, and Browns Canyon is one of the most popular whitewater rafting destinations in the United States.
- A wide variety of crops are grown on more than 220,000 acres of irrigated acreage in the Lower Arkansas River Basin, including the well-known Rocky Ford Cantaloupe.
- The High Plains aquifer in the eastern portion of the basin is considered a "Designated Basin" by the State of Colorado, meaning users rely primarily on groundwater for their supply. The High Plains aquifer is the major source of irrigation water for southeast Colorado.

For more information on the Arkansas Basin, see the Basin Implementation Plan available at:

Basin Implementation Plans | Colorado Department of Natural Resources
Grassland covers approximately 67 percent of the Arkansas Basin, primarily in the eastern portion, while forests cover the western region. The Upper Arkansas River supports diverse tourism and recreation and is renowned for its whitewater rafting and kayaking. In the Lower Valley below Pueblo, the river supports significant agriculture, primarily fodder crops and row crops such as pumpkins, squash, chiles, and melon fruits. In addition, the Arkansas Basin supplies water to approximately 1 million people. Basin projects that help to maximize beneficial use of the basin’s limited water resources include the Winter Water Storage Program, the Southern Delivery System, the future Arkansas Valley Conduit, and the Lower Arkansas Super Ditch. Trinidad Lake, Pueblo Reservoir, and John Martin Reservoir are key storage facilities for water users and flat-water recreators. Transmountain diversions from the Colorado Basin are an important source of supply for the Arkansas Basin.

### Water Resources Development Timeline

**1880**

In 1880, the Otero Canal Company built the Ewing Ditch near Tennessee Pass, west of the Continental Divide, to convey water from the Eagle River Basin to a tributary of the Arkansas River. The diversion, now owned by the Pueblo Board of Water Works, was the state’s first transmountain diversion.1

**1948**

The Arkansas River Compact of 1948 apportions the waters of the Arkansas River between Colorado and Kansas while providing for the operation of John Martin Reservoir. The John Martin Dam construction was also completed in 1948.

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1 Water Education Colorado. 2014. [*Citizen’s Guide to Colorado’s Transbasin Diversions*].
In 1959, after years of political lobbying by Arkansas Basin stakeholders, work began on the Fryingpan-Arkansas Project. Today the project delivers water for 265,000 acres of agricultural lands and supplies municipalities in the Colorado Springs area.²

The Arkansas Valley Conduit was authorized by Congress in 1962 as part of the Fryingpan-Arkansas Project.

The Pueblo Dam and Reservoir were constructed between 1970 and 1975 as the terminal storage feature for the Fryingpan-Arkansas Project.

In the 1980s, large changes of irrigation water rights occurred in the Twin Lakes Reservoir and Irrigation Canal Company due to pressure to develop adequate water supplies for growing populations. This resulted in the dry up of 45,000 acres in Crowley County alone.

By 1999, the City of Aurora had purchased approximately 95% of the Rocky Ford Ditch.³


³ Arkansas Basin. *Aurora Water Virtual Tour*
### Basin Challenges

- Concerns over permanent agricultural transfers and the effects on rural economies are substantial in the lower portion of the Arkansas Basin downstream of Pueblo Reservoir.
- Collaborative solutions such as the Super Ditch and ATM pilot projects, while difficult to design and decree, are necessary to forestall or minimize loss of irrigated acreage in agriculture.

### AGRICULTURE

- Concerns over water quality span protection of aquatic species in the Upper Basin to improving drinking water in the Lower Basin.
- Careful management of the environmental and recreational demands that are expected to increase with population growth, given that environmental and recreational demands depend on transmountain supplies, municipal storage, and agricultural demands.
- Managing impacts of fires and floods on an increasing frequency and spatial scale.

### WATERSHED

- Replacing municipal water supplies that depend on the non-renewable Denver Basin aquifers and declining water levels in designated basins is becoming critical, exacerbated by continued growth in groundwater-dependent urban areas.
- Rural areas within the Arkansas Basin have identified water needs but face challenges in marshalling resources to identify and implement solutions.

### MUNICIPAL AND INDUSTRIAL

- All uses not in priority must be augmented through a decreed plan of augmentation to prevent injury to senior water rights and the Compact. Increasing irrigation efficiency, i.e., conversion from flood to center-pivot irrigation for labor and cost savings, will require 30,000 acre-feet to 50,000 acre-feet of augmentation water in the coming years.
- The Arkansas River Compact creates complexity in water rights administration.

### COMPACTS, ADMINISTRATION, AND REGULATORY

- The majority of surface storage reservoirs in the Arkansas Basin were constructed between 1890 and 1930. Many of these facilities need repair or restoration.
- Agricultural water interests have faced encroachment by municipal demands, while environmental and recreational water demands have increased significantly.
- Water management is challenged by extreme or uncertain conditions, influenced by the over-appropriated water supply, reliance on imported water, complex hydrology and water administration, and extreme hydrologic conditions. Maintaining imported water supplies that are increasingly at risk is critical to meeting future demand.

### CROSS-SECTOR CHALLENGES

- Water-short basin
- Complex hydrology and extreme hydrologic conditions
- Complicated water rights administration
- Declining groundwater levels
- Increased demand for augmentation water
- Reliance on imported supplies
## Goals and Strategic Vision for the Future

The Arkansas Basin goals describe the specific things the basin needs to do to meet its future water-related needs, while the strategic vision considers the goals, challenges, and proposed basin projects to concisely describe a long-term strategy for meeting those needs.

### Goals

**AGRICULTURE GOALS**
- Support projects within and outside the Arkansas Basin that will help meet the basin's agriculture water supply gap, maintain existing supplies, better manage vulnerable supplies, and maximize use of water users' entitlements
- Sustain a productive agricultural economy in the Arkansas Basin that sustains viable rural, agricultural-based communities
- Provide augmentation water as needed to support increased farm efficiencies
- Support the development of viable ATM/ water-sharing projects between agriculture and municipal interests to mitigate the impacts of drought, provide risk management for agriculture and municipal interests, and facilitate responsible and sustainable water-sharing arrangements
- Sustain recreational and environmental activities that depend on habitat and open space associated with farm and ranch land

**MUNICIPAL AND INDUSTRIAL GOALS**
- Meet the projected municipal supply gap in each Arkansas Basin subregion
- Support regional efforts for cost-effective solutions to local water supply gaps
- Reduce municipal users' groundwater dependence on unsustainable aquifers
- Develop collaborative solutions among municipal, agricultural, and environmental and recreational users of water, particularly in drought conditions

**WATERSHED HEALTH GOALS**
- Maintain, improve, or restore critical water supply watersheds that could affect Arkansas Basin water uses and environmental and recreational values
- Improve water quality as it relates to the environment and/or recreation

**ENVIRONMENT AND RECREATION GOALS**
- Support projects and programs within and outside the Arkansas Basin that protect environmental and recreational water supply needs, and collaborate with municipal and ag users to enhance environmental and recreational values
- Maintain or improve native fish populations, restore habitat for fish species, and maintain or improve recreational fishing opportunities
- Maintain or improve boating opportunities, including rafting, kayaking, and other non-motorized and motorized boating
- Maintain or improve aquatic, riparian, and avian habitat (including wetlands) that would support environmental features and recreational opportunities

**STORAGE GOALS**
- Continue to develop storage opportunities to support Arkansas Basin needs\(^4\)
- Develop alluvial and designated basin aquifer storage in gap areas\(^4\)
- Promote multiple uses at existing and new storage facilities

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\(^4\) Subject to the constraints of the Arkansas River Compact
Strategic Vision for the Future

The Arkansas Basin, as an importing and exporting basin with interbasin and interstate obligations, must meet its present and future water supply gaps by maximizing the use of native and imported water.
Climate-impacted scenarios project an increase in municipal and industrial demands and risks to ecological resources even though basinwide agricultural demand is anticipated to reduce across scenarios; balancing water needs is crucial to meet future demands.
The Colorado Basin is a region of diverse natural systems, outstanding beauty, and extensive recreational opportunities.

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
Chapter 4: Basin Context

Basin Overview

The Colorado Basin encompasses approximately 9,830 square miles. It is among the largest watersheds in the state. The basin varies greatly in terms of topography, climate conditions, land use characteristics, population growth, economic base, and geology.

The Colorado Basin extends from Rocky Mountain National Park to the Utah state line within Colorado. 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 downstream water users. As much as 70 percent of the river’s water flows out of the state.

Basin Overview Facts

- 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.

- Groundwater plays a modest role in the Colorado mainstem basin’s water supply. Both the ready availability of good-quality surface water and the lack of highly transmissive aquifers worked against development of the groundwater resource.

- A substantial portion of the basin is made up of federally owned land. Of the almost 6 million acres in the basin, almost half is owned by the USFS. Rangeland controlled by the BLM is the second-most predominant land use. Livestock grazing, recreation, hunting, energy, and timber harvest are the primary uses of the federal lands.

- Agriculture is part of the basin’s historic culture. 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.

- Water providers in the South Platte and Arkansas Basins export approximately 480,000 acre-feet each year from the Colorado Basin for eastern slope agricultural, municipal, and industrial uses.

For more information on the Colorado Basin, see the Basin Implementation Plan available at: Basin Implementation Plans | Colorado Department of Natural Resources
The Colorado Basin is renowned for its ample outdoor recreation activities, such as Gold Medal fishing and diverse agriculture across the basin. 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.

Water Resources Development Timeline

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1882</td>
<td>In 1882, the Grand Valley Canal was established as the most senior water right in the basin.</td>
</tr>
<tr>
<td>1909</td>
<td>In 1909, operations began at the Shoshone Hydroelectric Plant, located in Glenwood Canyon. The plant has a maximum capacity of 15 megawatts produced by two 9-foot-tall turbines.</td>
</tr>
<tr>
<td>1917</td>
<td>In 1917, the Grand Valley Project opened as one of the earliest projects enabled under the Reclamation Act of 1902. The project serves the lands above Grand Valley Canal service area and on Orchard Mesa.</td>
</tr>
<tr>
<td>1922</td>
<td>In 1922, the seven Colorado River Basin states entered into the Colorado River Compact. This Compact allocated the consumptive use of the river between the Upper Basin and Lower Basin. Additional compacts and agreements were developed over time, as discussed in Chapter 3.</td>
</tr>
<tr>
<td>1930s</td>
<td>In a service tunnel for the early 1930s, two significant events occurred. Denver Water repurposed a service tunnel for Moffat Tunnel to deliver water from the Fraser River Basin to the South Boulder Creek. In 1937, the Colorado River Water Conservation District (River District) was formed by the Colorado General Assembly to advocate for and develop water resources for the benefit of western Colorado. The advent of the River District was a direct result of the difficult negotiations over the Colorado-Big Thompson (CBT) Project. Negotiations resulted in the construction of Green Mountain Reservoir, a project on the Blue River to compensate western slope water users for the export of water via the Adams Tunnel.</td>
</tr>
</tbody>
</table>
In 1952, Colorado Springs Hoosier Tunnel opened to convey water from the Blue River Basin and middle fork of the South Platte to the Arkansas Basin. In 1959, Denver Water’s Williams Fork Reservoir was completed to replace out-of-priority diversions to provide for western slope water rights.

The 1960s saw several new TMDs. In the early 1960s, the Fryingpan-Arkansas Project was authorized, which resulted in the transmountain Boustead Tunnel and Ruedi Reservoir to serve municipal and irrigation needs in the Arkansas Basin. In 1964, Denver Water began operating Dillon Reservoir and the Robert’s Tunnel, which moves water from the headwaters of the Blue River in Summit County to the South Platte River. In 1967, the Homestake Project was completed. The project was a joint undertaking of the Cities of Aurora and Colorado Springs to export water from the upper Eagle River to the Arkansas and South Platte Basins.

In 1985, the Windy Gap Project was completed for Northern Colorado entities, using CBT facilities on a space-available basis.

In 1995, Wolford Mountain Reservoir was completed. The reservoir was a collaboration among the Colorado River District, Denver Water, and Northern Water to benefit the western slope in the face of additional exports.

In 1995, the 15-mile Programmatic Biological Opinion was established to protect four species of endangered fish in the Grand Valley area.
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 potential for Colorado River Compact administration.

Challenges identified in the BIP are:

- **AGRICULTURE**
  - 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 that support environmental and recreation uses is vital. These are major drivers in the Colorado Basin and are important for economic health and quality of life.
  - Development of conditional transmountain water rights and potential full use of existing transmountain diversions is a concern, and the effect on in-basin supplies in the Colorado Basin must be considered.
  - There is concern over severe and sustained drought and the potential effects to in-basin supplies and potential compact administration. Demand management per the DCP is an issue of concern in the basin.

- **WATERSHED**
- **MUNICIPAL AND INDUSTRIAL**
- **COMPACTS, ADMINISTRATION, AND REGULATORY**

**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.
- Forest and watershed health is a basinwide challenge, especially given the impacts of recent wildfire activity. Insect infestations, avalanches, and sustaining riparian health are also challenges.

Ongoing collaboration through the Upper Colorado River Endangered Fish Recovery Program will be important to protecting this resource for all who rely on it.

See [Chapter 5](#) description of Endangered and Threatened Species Recovery Programs for more information.
Chapter 4: Basin Context

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

COLORADO BASIN ROUNDTABLE THEMES

Goals and Strategic Vision for the Future

- The Colorado Basin Roundtable developed six themes in its 2022 BIP, which are supported by goals. The themes represent the Colorado Basin Roundtable’s desired outcome or vision, and the basin roundtable supports and funds actions or activities related to the themes. The six themes are connected and interrelated and contain undercurrents of funding, education, climate change, and collaboration.
Strategic Vision for the Future

Strategies are general actions and pathways identified to meet and support the goals for the Colorado Basin. Strategies are intended to answer the question “How can the basin make progress toward its goals and achieve its vision?”

Strategies include:

• Fund the BIP
• Support and promote legislation, policies, and agreements that align with the goals
• Use the IWMP mechanism to reduce risks and enhance benefits across all sectors
• Implement projects that support goals
• Plan for uncertainty in water supply
• Address the gap
• Integrate PEPO Plan with the BIP Update
• Use the Colorado Basin Roundtable’s Next Steps Committee to support, foster, and implement these strategies

The Colorado Basin Roundtable vision focuses on providing much-needed water supply while supporting the local economy and protecting valuable resources.

Maroon Bells near Aspen Colorado, Photo credit: Colorado Basin Roundtable
Climate-adjusted scenarios project a reduction in flows and available water; storage in the Colorado Basin is critical to minimizing future gaps.
The Gunnison Basin has a strong agricultural heritage, rugged landscapes, and Gold Medal fisheries that attract large numbers of recreational tourists.

KEY ACHIEVEMENTS
A wide variety of projects in the Gunnison BIP provided numerous benefits to agricultural, environmental, recreational, and municipal water uses.

- Lower Gunnison Project
- Reservoir Rehabilitation on the Grand Mesa
- Upper Gunnison River Water Conservancy District Stream Management Plan project
- Selenium Compliance in the Lower Gunnison
Chapter 4: Basin Context

Basin Overview

The Gunnison Basin encompasses 8,000 square miles in western Colorado extending from the Continental Divide to the confluence of the Gunnison and Colorado rivers near Grand Junction. The Gunnison River is a major tributary of the Colorado River.

The Gunnison River begins at the confluence of the East and Taylor rivers, which are tributaries with headwaters in the Elk and West Elk mountains to the north and the Sawatch Range to the east. Cochetopa and Tomichi Creeks, flowing out of the Cochetopa Hills and San Juan Mountains to the south, join the river at Gunnison. At the upper end of its 53 miles are the reservoirs of the Aspinall Unit (Blue Mesa, Morrow Point, and Crystal). Below the reservoirs is the 14-mile Black Canyon of the Gunnison National Park. Below the canyon, the river crosses into the Colorado Plateau where the North Fork of the Gunnison joins the mainstem and passes the Grand Mesa. Separating the Gunnison Basin from the mainstem Colorado, the Grand Mesa rises a vertical mile to 11,000 feet, which provides dramatic variation in climate and vegetation over a short distance.

The Uncompahgre River is the last major tributary to the Gunnison. It rises among 13,000- and 14,000-foot peaks in the vicinity of Ouray and flows nearly due north. The river valley forms a relatively broad alluvial plain that contains the towns of Montrose, Olathe, and Delta. Beyond the Uncompahgre confluence, the Gunnison River flows northwest to Grand Junction and gains flows from both the Grand Mesa to the east and the Uncompahgre Plateau.

Basin Facts

- Annual precipitation averages more than 40 inches in the high mountains but less than 10 inches in the lower Gunnison and Uncompahgre Valleys.
- Surface water hydrology is snowmelt-driven, with the majority of runoff occurring in two or three months of the year.
- The Gunnison River contributes one-fifth to one-sixth of the overall Colorado Basin's total annual flow leaving the state (considering the mainstem and other basin rivers like the Yampa, White, and those in the Southwest Basin).
- Agricultural use accounts for the majority of water consumption within the basin. More than 250,000 acres are irrigated, which waters pastures, orchards, wine grapes, commodity grains, forage crops, and vegetables.
- Livestock production is an important economic driver, with numerous cow/calf operations using irrigated lands as an important base of operations. In fact, beef production accounts for more than $110 million in yearly economic output (2016 number).
- A recent study determined total economic contributions of water-related recreation activities were $461 million in 2019.
- Hydropower generation is an important nonconsumptive use of surface water throughout the entire basin and has historically used more than 3 million acre-feet per year.

For more information on the Gunnison Basin, see the Basin Implementation Plan available at: Basin Implementation Plans | Colorado Department of Natural Resources

6 Department of Natural Resources, Division of Minerals and Geology. 2003. Colorado Geological Survey
The Gunnison Basin is home to the Black Canyon of the Gunnison National Park and Curecanti National Recreation Area, which are some of the top tourist destinations in the state. Agriculture is the principal consumptive use and accounts for 97 percent of water diversions. Two reservoirs, Taylor Park and Ridgway, are used to store water for supplemental irrigation water supply and release for fish flows. Paonia, Crawford, Silverjack, Gould, Overland, and Fruitgrowers Reservoirs are primarily used for irrigation. The Redlands Power Canal, operated by the Redlands Water and Power Company, exports up to 850 cfs of water to the Colorado Basin for irrigation and power generation.

Water Resources Development Timeline

1909

In 1909, the Gunnison Tunnel was completed. The tunnel serves the Uncompahgre Project and brings approximately 390,000 acre-feet annually from the Gunnison River to supply irrigators and municipalities in the tributary Uncompahgre River Basin.

1922

In 1922, the seven Colorado River Basin states entered into the Colorado River Compact. This Compact allocated the consumptive use of the river between the Upper Basin and Lower Basin. Additional compacts and agreements were developed over time, as discussed in Chapter 3.

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* American Society of Civil Engineers. 2022. Historic Landmarks Gunnison Tunnel.
In 2008/2009, the Black Canyon of the Gunnison National Park Federal Reserved Water Right was finalized. The water rights decree mandates base instream flow plus a 1-day peak flow, both in amounts to be determined annually according to a formula based on inflows to Blue Mesa Reservoir.16

In 1956, the Colorado River Storage Project Act (CRSPA) was passed. Three reservoirs in the basin—Blue Mesa, Morrow Point, and Crystal—comprise the Aspinall Unit of the CRSPA. CRSPA reservoirs were constructed to allow the Upper Basin states to develop their Colorado River Compact apportionment while meeting their Compact obligations. CRSPA reservoirs also provide important hydroelectric power generation.

Basin Challenges

Protecting existing water uses is the unwavering goal and main challenge in the Gunnison Basin. Water users and managers must address how to use the limited water resources to maintain agriculture while providing water for growing municipalities and meeting nonconsumptive needs like environmental, recreation, and hydropower. Stretching water supplies to meet multiple needs will be made more difficult by climate change. Challenges identified in the BIP are:

**AGRICULTURE**
- Addressing agricultural water shortages across the basin is a significant challenge.
- Lack of financial resources for new infrastructure projects and rehabilitation of aging infrastructure is a major barrier to improved water management.
- Loss of productive agricultural land to other uses remains a concern in many areas.
- Climate-driven change adds risk and uncertainty to agricultural productivity and development.
- Tourism is important in the headwaters, but agriculture is dominant in the Uncompahgre Valley. A rapid influx of retirees and growth in the Uncompahgre Valley may dramatically change land uses in the area.

**WATERSHED**
- Regulatory drivers associated with the ESA and CWA create a complex set of environmental issues related to water quality, water quantity, and associated impacts to fish and wildlife habitat.
- There is a need for better watershed health-management tools to mitigate wildfire risk and sedimentation in streams.
- Environmental and recreational flows may be met less often in climate-impacted scenarios, especially in reaches with increased consumptive needs.
- Protecting existing supply infrastructure after wildfire is a concern that has not been adequately addressed.

**MUNICIPAL AND INDUSTRIAL**
- Population growth in the headwater regions will require additional water management strategies.
- Development of irrigated lands around urban areas will continue in all planning scenarios. There are legal and administrative challenges to using water from the converted agricultural lands to fill municipal gaps.
- Climate-driven changes to hydrology may impact the reliability or resiliency of historical municipal supplies.

**COMPACTS, ADMINISTRATION, AND REGULATORY**
- Successfully resolving endangered species issues on the Colorado River and meeting environmental needs in a manner that does not adversely impact existing uses remains a challenge.
- Changes in the operations of CRSPA reservoirs could impact the Gunnison Basin. Protecting existing uses in the basin is a major concern.

KEY CHALLENGE

In the Gunnison Basin, stakeholders will need to manage water demand from agriculture and growing communities while also maintaining sufficient flows for endangered species, water-based recreation, and hydropower generation for a range of climate-impacted scenarios.
Goals and Strategic Vision for the Future

The Gunnison Basin goals describe the specific things the basin needs to do to meet its future water-related needs, while the strategic vision considers the goals, challenges, and proposed basin projects to concisely describe a long-term strategy for meeting those needs.

**Goals**

- Protect existing water uses in the Gunnison Basin
- Discourage the conversion of productive agricultural land to all other uses within the context of private property rights
- Improve agricultural water supplies to reduce shortages
- Identify and address municipal and industrial water shortages
- Quantify and protect environmental and recreational uses
- Maintain or, where necessary, improve water quality throughout the Gunnison Basin
- Describe and encourage relationships among agricultural and environmental recreational water uses
- Restore, maintain, and modernize critical water infrastructure
- Create and maintain active, relevant, and comprehensive public education, outreach, and stewardship processes involving water resources in the six sectors of the Gunnison Basin
Strategic Vision for the Future

The Gunnison Basin Roundtable strives to protect existing water by balancing municipal, agricultural, environmental, and recreational water needs.

• Implement projects
• Leverage funding opportunities
• Expand weather modification programs
• Improve infrastructure
• Protect environmental and recreational values
• Prepare for climate change

Wildflowers in open range, Photo credit: Gunnison Basin Roundtable
Conservation and efficiency measures can help mitigate issues associated with growing municipal and industrial demands, higher water supply gaps (especially in future scenarios with climate change), and risks to ecological attributes.
The North Platte Basin is a high-altitude valley that supports irrigated pastures and ranching operations as well as diverse recreational opportunities.

**KEY ACHIEVEMENTS**

Key projects helped advance goals while providing agricultural, environmental and recreational, and municipal benefits. Projects include:

- Agricultural Infrastructure Improvements
- Airborne Cloud Seeding Project
- North Park Lysimeter Study

*Windmill on farmland, Photo credit: North Platte Basin Roundtable*
Chapter 4: Basin Context

Basin Overview

The North Platte Basin, also known as North Park, is a high-altitude valley covering about 2,000 square miles in north-central Colorado. It includes all of Jackson County and the small portion of Larimer County in the Laramie River watershed.

The North Platte Basin drains the north-central portion of Colorado and consists of the North Platte River and two major tributaries: the Laramie River and Sand Creek. The North Fork, Grizzly Creek, Michigan River, Canadian River, and Illinois River are tributaries that flow into the North Platte River in Colorado. Sand Creek and the Laramie River are divided from North Park by the Medicine Bow Mountains, which form the east rim of North Park. They flow northward out of Colorado and join the North Platte River in Wyoming.

Water use in the basin is dominated by irrigated pastures associated with ranching operations. The basin also has a major wildlife refuge in addition to numerous public lands and recreational opportunities.

Basin Facts

- The North Platte Basin is sparsely populated. The largest town in the basin, Walden, is centrally located in Jackson County. It has a population of approximately 600, and it serves as the basin’s central hub. Jackson County has approximately 1,400 permanent residents; however, visitors to the region for hunting, fishing, and recreational opportunities expand the population, particularly during summer.

- The North Platte Basin relies on ranching and outdoor recreation, especially hunting, as its main industries. The Arapaho National Wildlife Refuge, as well as other federal land and State Forest State Park, provide excellent fishing, hunting, and wildlife viewing areas.

- Water use in the basin is dominated by irrigated pasture grass, with more than 400 irrigation ditches diverting from the mainstem and numerous tributary streams throughout the basin. Total irrigated area based on 2016 estimates is approximately 113,600 acres, consisting of 110,200 acres in North Park and 3,400 acres in the Laramie River watershed.

- With average annual precipitation in the mountains of approximately 40 inches per year, the many tributaries in the basin are fed by spring snowmelt that results in peak runoff in May and June. Streamflow decreases rapidly throughout the summer and is considerably lower by September and through the winter months.


For more information on the North Platte Basin, see the Basin Implementation Plan available at: Basin Implementation Plans | Colorado Department of Natural Resources
In the North Platte Basin, ranching is a way of life, with grass hay primarily grown to support cattle operations. Hunting, fishing, and recreational opportunities are plentiful and support a strong tourism industry. There are two Gold Medal water designations—Delany Butte Lakes, and North Platte River from the southern boundary of the Routt National Forest downstream to Wyoming. The Arapaho National Wildlife Refuge is in the heart of the basin. It provides important habitat for waterfowl, migratory birds, and local wildlife. The North Platte Basin is home to the only state forest in all of Colorado. In addition, the North Platte and Laramie River basins export water to the South Platte Basin for agricultural, municipal, and industrial purposes.

Water Resources Development Timeline

- **1945**: In 1945, the Nebraska v. Wyoming decree was issued after 11 years of litigation. The decree made an equitable apportionment of the water use among Colorado, Wyoming, and Nebraska.
- **1957**: In 1957, the Wyoming v. Colorado decision established the rights of Colorado and Wyoming to water in the Laramie River and limits Colorado’s total diversions and exports from the basin.
- **1967**: In 1967, the Arapaho National Wildlife Refuge was established to provide suitable nesting and rearing habitat for migratory birds. The 23,834-acre refuge supports diverse wildlife habitats, including sagebrush steppe uplands, grassland meadows, willow riparian areas, and wetlands.
In 2006, the Colorado’s Plan for Future Depletions of the Platte River Recovery Implementation Program (PRRIP) was finalized. The PRRIP uses land, water, and funding components to protect critical habitat located in Nebraska and provide ESA compliance for water projects in Colorado, Nebraska, and Wyoming.

In 2001, the Nebraska v. Wyoming settlement package, a comprehensive agreement between Colorado, and Nebraska resolving outstanding issues and laying out a program for future cooperation and oversight, was approved. The agreement limits the amount of available storage supplies and lands that can be irrigated on the North Platte Basin as well as exports from the basin.
### Basin Challenges

The North Platte Basin faces several key issues and challenges pertaining to water management, endangered species, and resource development. Challenges identified in the BIP are:

#### AGRICULTURE
- Gaining a better understanding of the basin's consumptive uses and high-altitude crop coefficients
- Increasing agricultural demands and unmet needs by 8 to 14 percent due to potential climate change, though agronomic practices and technological improvements may offset these effects
- Developing water supplies to serve additional irrigated area while maintaining compliance for endangered species
- Maintaining and replacing aging agricultural infrastructure to preserve existing uses, increase efficiencies, and put additional acreage into production

#### WATERSHED
- Maintaining healthy rivers through the strategic implementation of projects that meet prioritized environmental and recreational needs
- Monitoring and enhancing forest health and management efforts as it relates to forest beetle kill and potential wildfires in the basin
- Peak runoff timing potentially occurring earlier in the year with climate change, which poses potential risks to trout fisheries

#### MUNICIPAL AND INDUSTRIAL
- Increasing economic development and diversification through strategic water use and development
- Developing water supplies, such as storage and augmentation plans, for future industrial opportunities

#### COMPACTS, ADMINISTRATION, AND REGULATORY
- Maintaining compliance with the equitable apportionment decrees on the North Platte and Laramie Rivers that quantify the amount of available water and lands that can be irrigated
- Continue collaborative approach to providing for the needs of endangered species while protecting existing uses
- Promoting water-rights protection and management through improved streamflow-gaging data

The North Platte Basin will need to balance limits to consumptive uses and endangered species issues with sustaining the basin's agricultural economy and protecting forest and overall watershed health.
Goals and Strategic Vision for the Future

The North Platte Basin goals describe the specific things the basin needs to do to meet its future water-related needs, while the strategic vision considers the goals, challenges, and proposed basin projects and concisely describes a long-term strategy for meeting those needs.

**Goals**

- Maintain and maximize the consumptive use of water permitted in the Equitable Apportionment Decree and the baseline depletion allowance in Colorado’s Plan for Future Depletions
- Increase economic development and diversification through strategic water use and development
- Continue to restore, maintain, and modernize critical water infrastructure to preserve current uses and increase efficiencies
- Maintain healthy rivers and wetlands through the strategic implementation of projects that meet prioritized environmental and recreational needs
- Describe and quantify the environmental and recreational benefits of agricultural use
- Promote water rights protection and management through improved streamflow gaging data
- Enhance forest health and management efforts for wildfire protection and beetle kill impacts to watershed health
- Support the continued development of local municipal infrastructure and water supplies

**NORTH PLATTE BASIN ROUNDTABLE GOALS**
Strategic Vision for the Future

Project implementation is the primary strategy of the North Platte BIP for addressing basin goals. The BIP included project implementation strategies, which are discrete steps to take projects from conception to completion. These implementation strategies typically involve two primary categories of action prior to project completion: securing project acceptance and demonstrating project feasibility. The strategies are:

- Implement projects
- Address constraints to project implementation

The table to the right summarizes strategies to overcome constraints related to securing project acceptance and demonstrating project feasibility to allow implementation of projects proposed for the North Platte Basin.

The North Platte Basin Roundtable prioritizes sustaining agricultural development while protecting endangered species, developing resources, and maintaining healthy forests and watersheds.

![North Platte, Photo credit: North Platte Basin Roundtable](image-url)
Agricultural demands are anticipated to increase, and climate-impacted scenarios present larger gaps in addition to risks to environmental attributes; however, basinwide storage supplies will generally remain similar to current conditions.
The Rio Grande Basin is a region of outstanding beauty, unique water resources, and abundant wildlife that supports diverse communities with a rich cultural heritage.

KEY ACHIEVEMENTS
A diverse range of projects have been completed that support the BIP and Colorado Water Plan goals:
- Completion of stream management plans and watershed assessments
- Implementation of stream, wetland, and riparian conservation and restoration projects
- Implementation of tools for accurate streamflow forecasting
- Rehabilitation of irrigation infrastructure for multiple benefits
- Implementation of multi-purpose storage infrastructure improvements
- Completion of projects that enhance recreational opportunities
- Formation and operation of groundwater management subdistricts
Basin Overview

The Rio Grande Basin is surrounded by three mountain ranges: the Sangre de Cristo to the east, the Culebra Range to the southeast, and the San Juan Mountains to the west, and is bound by the Colorado-New Mexico state line to the south. Between these mountain boundaries and the state line lies the San Luis Valley, a unique geographic feature. The San Luis Valley is a high-elevation desert with an average elevation of approximately 7,500 feet and average annual precipitation of less than 8 inches. Despite the low precipitation on the valley floor, agriculture has long been the basis of the Rio Grande Basin's economy. Snowmelt runoff and summer storms from the surrounding mountains supply the vast majority of water to streams and aquifers, which support irrigated agriculture, recreation, municipal and industrial uses, and important riparian and wetland ecosystems. The extensive riparian and wetland habitats support over 160 species of birds, including the entire Rocky Mountain Population of greater sandhill cranes.

The northern third of the Rio Grande Basin is a closed basin, meaning runoff from the surrounding mountains and diversions from the Rio Grande recharge the basin's groundwater aquifers, rather than contribute to the surface water flow of the Rio Grande. Irrigated agriculture in the Rio Grande Basin relies heavily on well pumping from the aquifers as well as surface deliveries supplied by the Rio Grande, Conejos River, and other streams. These diversions are applied directly to crops and, due to the nature of the basin's hydrogeology, contribute to recharge of the unconfined and confined aquifers.

The Rio Grande Basin also has a long history of water resources development and holds many of the oldest adjudicated water rights in Colorado, including acequias. The Rio Grande Basin is made up of diverse communities with a rich cultural heritage. Many historic and traditional water uses and management practices continue today. The Rio Grande Basin Roundtable is committed to cultivating a culture of accessibility and inclusivity that reflects the basin's diverse communities and values.

Basin Overview facts

- The San Luis Valley is a high-elevation desert that receives less than 8 inches of precipitation per year. Precipitation is more abundant in higher elevations surrounding the valley.
- Water diverted for irrigation from streams is fed by snowmelt. Dry-year runoff can be eight times less than average. Reservoirs store water from streams and release water when irrigators need it most.
- Groundwater is an important water supply in the San Luis Valley; however, the supply is declining.
- Agriculture is the primary economic driver in the basin, with roughly 520,000 acres of irrigated land. Potatoes are one of the primary crops grown in the basin, making it the second-largest fresh market potato growing region in the nation.
- Watershed planning has targeted rehabilitation of aging infrastructure, restoration of natural stream channels, and improved recreational access to the river.
- The basin's thriving tourism industry is water and snow dependent, and its 2 million acres of public land, which includes the Rio Grande National Forest, Great Sand Dunes National Park and Preserve, several wilderness areas, wildlife areas and refuges, and the Wolf Creek Ski Area, attracts thousands of visitors to the region annually.

For more information on the Rio Grande Basin, see the Basin Implementation Plan available at: Basin Implementation Plans | Colorado Department of Natural Resources

San Luis Valley - Colorado Encyclopedia
The Rio Grande Basin’s borders are defined by the Colorado–New Mexico state line on the south, the La Garita range on the north, the San Juan Mountains on the west, and the Sangre de Cristo and Culebra mountains on the east. Between these mountains lies the San Luis Valley, a large intermountain valley that is part of the larger Rio Grande rift. The northern third of the basin is a closed basin, meaning runoff from the surrounding mountains and diversions from the Rio Grande recharge the basin’s groundwater aquifers, rather than contribute to surface water of the Rio Grande. Reservoir storage is limited but critically important for basin water users. The basin supports a strong agricultural economy, with roughly 520,000 acres of irrigated land and Colorado’s oldest water right. Recreational opportunities abound, due in part to abundant wildlife supported by extensive wetlands and riparian areas.

**Water Resources Development Timeline**

- **1852**
  
  In 1852, the San Luis People’s Ditch made its first use of water and is the oldest water right in Colorado. Still used today to irrigate more than 2,000 acres of land with water diverted from the Culebra Creek, the ditch is the oldest community irrigation ditch in Colorado.

- **1900**
  
  Surface streams in the San Luis Valley were over-appropriated in approximately 1900.

- **1938**
  
  The interstate Rio Grande Compact of 1938 among Colorado, New Mexico, and Texas equitably apportions the waters of the Rio Grande above Fort Quitman, Texas. The volume of water that Colorado and New Mexico must deliver varies annually based on streamflow at designated index gages.

- **1963**
  
  The Amended Costilla Creek Compact of 1963 equitably apportioned the waters of Costilla Creek between Colorado and New Mexico.
In 1972, Congress authorized the Closed Basin Project, which consists of numerous wells and canals that deliver water to the Rio Grande. Project deliveries help the State of Colorado meet its compact commitments, enhance wildlife in protected areas, and allow for greater diversions upstream where the water is needed for irrigation.

In 1972, the State imposed a moratorium on the construction of new high capacity wells in the confined aquifer and aquifers tributary to the Rio Grande.

In 1981, the State imposed a moratorium on the construction of new high capacity wells in the unconfined aquifer of the San Luis Valley closed basin.


Well Rules and regulations were submitted (2015), approved by water court (2019) and came into effect (2021).
### Basin Challenges

- **Agriculture**: Diminishing supplies that call for reduced pumping as a result of unsustainable groundwater use in the unconfined aquifer. Mitigating potential economic fallout of the projected reduction in irrigated acres. The scope and financial resources needed to replace and improve aging and inefficient irrigation infrastructure.

- **Watershed**: Changing conditions of the watershed, including stream and wetland degradation, affect water supply, with direct impacts to environmental, recreational, and agricultural attributes. Water-dependent wildlife species are being considered for, or are already listed as, “threatened” or “endangered” under the ESA.

- **Municipal and Industrial**: Most cities and towns are supplied by groundwater wells and must comply with the State Engineer’s Well Rules and Regulations. Growth of commercial uses throughout the basin, new homes near Alamosa, and second homes in the surrounding mountains are creating a need for additional water supplies and well augmentation. Resources are needed to upgrade aging municipal infrastructure and to comply with water quality standards.

- **Compacts, Administration, and Regulatory**: The continued operation of the Rio Grande Compact and water rights administration under changing and variable hydrologic conditions.

### CROSS-SECTOR CHALLENGES

- Achieving confined and unconfined aquifer sustainability, as defined by statute and the Division 3 groundwater use rules, within the timeline established by the State Engineer and local groundwater management plans.
- Prolonged and lingering drought, wildfires, beetle kill, ecosystem degradation, climate change, extreme weather, flooding, and dust-on-snow impacts on timing and amount of water supply. These large disturbances can cause severe and lasting impacts on watershed health, including current and future decreases in average streamflow and water tables.
- The need for updated and additional storage, and the costly and time-consuming permitting process of these water projects.
- Increased pressure for transmountain water exports.
- Adequate funding for project implementation.
Goals and Strategic Vision for the Future

The Rio Grande Basin goals describe a long-term vision for the basin and ultimately strive for a resilient and healthy watershed and economy for generations to come.

Healthy watersheds that provide critical ecosystem services, are resilient to disturbances, and benefit from ongoing efforts to protect water sources, improve water quality, maintain connected ecosystems, and enhance aquatic, riparian, wetland, and upland habitat.

Aquifers with sustainable supplies of groundwater for farmers and ranchers, towns, and wildlife habitat.

Vibrant and resilient agricultural, recreational, municipal, and industrial economies that support thriving communities.

Water administration that is adaptive, flexible, and creative while complying with state statutes and the doctrine of prior appropriation, and fully utilizing Colorado’s entitlements under the Rio Grande and Costilla Creek Compacts.

Engaged and informed citizens who understand the scope and urgency of local, state, and regional water issues and participate in robust and diverse educational opportunities.
Strategic Vision for the Future

The Rio Grande Basin faces significant water resources management challenges now and into the future. To help meet the basin's water needs, the Rio Grande Basin Roundtable developed specific strategies that work toward a vision of achieving a sustainable water future for a variety of water users and uses. Basin stakeholders recognize that water can meet multiple needs as it flows through the Rio Grande Basin, as illustrated below. Therefore, implementation of future strategies will require continued coordination, innovation, and a focus on achieving multiple benefits. The Rio Grande Basin Roundtable will pursue the following strategies:

- Support flexible and adaptive water management
- Implement diverse and multi-purpose projects
- Address agricultural supply gaps through increased efficiency and by upgrading water storage and other agricultural infrastructure
- Support environmental and recreational attributes through habitat conservation and restoration
- Conduct municipal water infrastructure upgrades
- Implement projects to meet potential future water supply gaps

To help meet the basin’s current and future water needs, the Rio Grande Basin Roundtable, stakeholders, and the community will employ adaptive strategies that promote resilience and allow for flexible water-sharing agreements, within the context of Colorado’s water laws.

The Many Uses of Water in the Rio Grande Basin in Colorado

(illustration by Andréa Bachman)
Demand, Supply, and Potential Water Needs

Climate-impacted scenarios project increased variability in water supplies, which will have impacts on all water uses and will require collaborative water management strategies.
The South Platte Basin covers a diverse topography, offering a wide range of ecological systems, and is home to a significant portion of the state’s population.

**KEY ACHIEVEMENTS**

Key projects and efforts demonstrate successes in meeting basin goals and water needs:

- Aquifer Storage and Recovery
- Charlie Meyers State Wildlife Area Habitat Enhancement Project
- Chatfield Reservoir Reallocation
- Direct Potable Reuse Demonstration
- Environmental Water Needs and Concerns
- Protecting the Future of Agriculture
- Greeley Municipal Water Conservation
- Protection and Enhancement of Forest and Watershed Health
- Resource Central – Conservation Made Easy
- South Platte Regional Opportunities Water Group Feasibility Study
- Southern Water Supply Pipeline II
- Stakeholder Understanding in Water Supply Planning
Basin Overview

The South Platte Basin is Colorado's most industrialized and populous basin, and with more than 850,000 irrigated acres also has the greatest concentration of irrigated agricultural lands in Colorado. Approximately 70 percent of Colorado's population resides in the South Platte Basin, and the Front Range area of the basin is Colorado's economic engine. The combined South Platte and Metro basins (including the Republican River Basin) covers approximately 27,700 square miles in northeast Colorado. The largest cities in the basin are Denver, Aurora, and Fort Collins.

The topography of the South Platte Basin is diverse and originates in the mountain streams along the northern portion of the Front Range. After emerging from the forested mountains southwest of the Denver metropolitan area, the main stem moves north through the Denver urban area, then east across the High Plains, which is mainly grassland and planted/cultivated land. Major tributaries include Bear Creek, Boulder Creek, Cherry Creek, Clear Creek, St. Vrain Creek, Big Thompson River, and the Cache la Poudre River. The South Platte River crosses the Colorado-Nebraska state line near Julesburg and merges with the North Platte River in southwestern Nebraska to form the Platte River.

The Republican River drains approximately 7 percent of the state's area in northeastern Colorado. The area is mostly agricultural, with more than 550,000 irrigated acres. Some water supply in the basin comes from the Republican River and its tributaries, but the primary source of water is groundwater from the Northern High Plains Aquifer, also known as the Ogallala Aquifer.

Basin Overview Facts

• In general, most of the precipitation falls as rain in the late spring and as snow during winter, with dry conditions in between. The average October-April precipitation in the basin varies from 3 inches in the lower plains to 22 inches in the mountains, and 6 and 15 inches, respectively, for the plains and mountains during May-September.

• The hydrology of the South Platte Basin is highly variable, with about 70 percent of the annual streamflow occurring during spring runoff.

• The amount of diversion exceeding native flow highlights the return flow-dependent nature of the basin's hydrology and the basinwide efficient use and reuse of water supplies.

• Groundwater resources of the South Platte Basin consist primarily of a relatively shallow unconfined alluvial aquifer along the mainstem and tributaries and the deeper, confined Denver Basin aquifers below some areas of the basin. The Republican River Basin is underlain by the High Plains or Ogallala aquifer, which is one of the largest aquifer systems in the United States.

• Several communities in the southern Denver metropolitan area are growing rapidly and rely on nonrenewable groundwater (Douglas and Arapahoe counties).

• Urban business and industry within the basin drive the majority of the state's overall economy. The basin is also the highest-producing basin in the state in terms of the value of agricultural products sold.

• The basin supports a wide range of ecological systems and important water-dependent recreational and ecological attributes. Coloradans and tourists regularly enjoy the recreational opportunities provided by the basin's many environmental features.
Approximately 70% of the state’s population is located along the Front Range in the South Platte Basin and it is projected to continue to grow in the future. Rocky Mountain National Park is one of many places in the basin that draws locals and tourists into the great outdoors. Gold Medal fisheries, rafting, and skiing abound along the Foothills. With more than 850,000 irrigated acres, the South Platte River Basin irrigates the most acreage of any basin in the state. Irrigation and municipal water demands in the basin require significant storage, groundwater pumping, and transmountain imports from the West Slope to manage and supplement in-basin supplies.

Water Resources Development Timeline

1800s
In the late 1800s, agricultural water rights for irrigation and storage began to be developed throughout the South Platte Basin.

1923
In 1923, Colorado and Nebraska formalized the South Platte River Compact, which appropriates the rights to use water in the South Platte River and Lodgepole Creek.

1928-1936
Built in 1928, Moffat Tunnel was the largest railroad tunnel in the Western Hemisphere. In 1936, Denver Water began diverting water through a pipeline in the Moffat Tunnel for transmountain use, conveying water via South Boulder Creek and Gross Reservoir to meet Front Range water demands.

1937
Colorado–Big Thompson Project was authorized in 1937 by Franklin D. Roosevelt. Construction began on Green Mountain in 1938 and continued for the next 20 years. The project was originally built to generate hydropower and meet agricultural demands, but the population growth along the Front Range has shifted demands to municipal and industrial uses.

1943
Following drought in the 1930s and a flood to the Republican River basin in 1935, Colorado, Kansas, and Nebraska negotiated the Republican River Compact in 1943 to apportion the basin’s water supply among the three states.12

12 Republican River Compact Administration. 2022.
In 1985, Senate Bill 5, also known as the Denver Basin Rules, provided the legal framework for how groundwater in the Denver Basin should be allocated.

In 2002, the Republican River Compact’s Final Settlement Stipulation was signed, which included detailed accounting procedures and a jointly developed groundwater model.

In 2007, PRRIP began. The program works to assist in the recovery of four target species while providing water users with regulatory certainty and ESA compliance.
Basin Challenges

Challenges in the South Platte and Republican River basins are related to water scarcity. Growth, coupled with existing scarcity and future uncertainty, will stress already-overallocated water resources. On a positive note, scarcity has led to many creative water supply solutions and opportunities.

<table>
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<tr>
<th>AGRICULTURE</th>
<th>WATERSHED</th>
<th>MUNICIPAL AND INDUSTRIAL</th>
<th>COMPACTS, ADMINISTRATION, AND REGULATORY</th>
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<tr>
<td>• Many groundwater irrigators rely on alluvial aquifer recharge for augmentation supply, but high groundwater tables have presented challenges in some areas. Also, recharge supplies sometimes go unused and could potentially be optimized.</td>
<td>• Protection of watersheds and the forests within them requires management of large areas of land that may be owned or managed by multiple entities and may be difficult to access.</td>
<td>• Reuse is an important source of supply, and strides are being made to overcome technical, regulatory, and public acceptance obstacles that currently hinder expanding water reuse.</td>
<td>• The Republican River Basin will continue to be challenged with Republican River Compact compliance and maintaining economic prosperity as basin groundwater continues to be mined.</td>
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<td>• Urbanization and permanent transfer of agricultural supplies for municipal and industrial use will decrease irrigated lands and impact the agricultural economy and open space.</td>
<td>• While funding assistance programs exist, they do not fully meet the need for watershed and environmental and recreation project planning and implementation.</td>
<td>• Improving municipal and industrial water use efficiency will remain a key element of water resources management, but significant future gains will require continued, concerted efforts.</td>
<td>• Significant time and money are needed to comply with federal, state, and local permitting; prepare federal agency-led environmental impact statements; and finalize regulatory decisions and mitigation.</td>
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<td>• Financial resources are needed to maintain or replace aging irrigation infrastructure.</td>
<td>• Climate change may degrade watershed health, increase the risk of wildfire, impair water quality, and increase risk to environmental and recreation attributes.</td>
<td>• While the Denver Basin aquifer can be a viable water supply, it is challenged by uncertainty in statutory allocation of water and declining water levels that may limit its use to only drought resilience in some areas.</td>
<td>• Additional data are needed to evaluate the health of streams and watersheds more completely and identify ways to improve conditions.</td>
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<tr>
<td>• The rapid increase in value of water rights makes it difficult to acquire additional irrigation supplies and increases “buy and dry” pressure.</td>
<td>• Additional data are needed to evaluate the health of streams and watersheds more completely and identify ways to improve conditions.</td>
<td>• Identifying environmental and recreational flow needs is challenging because of technical issues and lack of data, and also due to overlapping and sometimes competing environmental and recreation needs.</td>
<td>• Financial and regulatory uncertainty are impacting the successful implementation of long-planned water projects, which may exacerbate future shortages in the basin.</td>
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Chapter 4: Basin Context

The PRRIP is a collaborative stakeholder driven process that provides ESA compliance for water users throughout the basin while ensuring the protection of threatened and endangered species. In 2019, the First Increment of the program was extended for an additional 13 years by BOR, Colorado, Wyoming, and Nebraska.

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<tr>
<td>• An aging workforce and steep costs for entry into agriculture present challenges to industry sustainability.</td>
<td>• Traditional metrics for monitoring stream health are outdated or difficult to monitor.</td>
<td>• Aquifer storage and recovery is a promising water storage strategy, but complications of water quality and available infrastructure and land need to be overcome.</td>
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<td>• Decreased water availability in the future due to declining aquifer levels in the Republican River Basin and designated basins, as well as diminished surface supplies from climate change, will impair farmers’ ability to fully irrigate crops.</td>
<td>• Increased water use in other sectors can reduce water available to environmental and recreational attributes and create additional risk.</td>
<td>• Water quality will be a challenge as increased use of native South Platte surface water will lead to water treatment and brine disposal issues.</td>
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<td>• Urban agriculture faces several challenges (some of which are similar to rural agriculture), but the primary challenge is access to affordable land.</td>
<td>• Loss of irrigated land from urbanization and water transfers can have negative effects on migratory birds, wildlife movement corridors, wetland/riparian habitat, water quality, and floodplains, especially if revegetation is inadequate and local return flows are not maintained.</td>
<td>• Water supplies will be needed to meet growing municipal and industrial demands that will occur beyond the current Technical Update planning horizon of 2050.</td>
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<td>• While environmental issues have been a focus in recent years, ignoring them can increase, for example, wildfire or water quality risks.</td>
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<td>CROSSED-SECTOR CHALLENGES</td>
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<td>• Competition for scarce water supplies is driving up water costs and posing challenges to meeting future municipal, industrial, and agricultural water needs while protecting and enhancing the environmental and recreation opportunities. Climate change may exacerbate this challenge.</td>
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<td>• Water supply solutions and strategies can have unintended consequences for other water users in the basin. For example, return flows, driven by the use and successive reuse of water, are a fundamental characteristic of supply in the South Platte River Basin. Efficiency improvements (whether municipal or agricultural), reuse, and watershed health projects involving recharge can reduce or change the timing of return flows that supply downstream water users of all sectors.</td>
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<td>• Basin stakeholders will need to continue focusing on the requirements of the PRRIP as additional native South Platte supplies are developed to meet current and future needs.</td>
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<td>• Collaborative multipurpose regional projects, while attractive, can be challenging to implement due to limited or dispersed sources of supply; permitting, regulatory, and institutional issues; longer project development timeframes; and increased public involvement.</td>
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<td>• Climate change creates substantial uncertainty and may increase water demands in all sectors, reduce overall supply, and create resiliency challenges that need to be considered in current planning.</td>
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Goals and Strategic Vision for the Future

The strategic vision considers the goals, projects, and desired water future for the basin and concisely describes the strategies needed to meet future challenges. The strategic vision for the South Platte and Metro Basin Roundtables focuses on four elements:

• Meeting the municipal supply gap
• Protecting irrigated agriculture
• Protecting and enhancing watersheds
• Implementing projects

Creative and collaborative water supply solutions are needed to support northeast Colorado’s growing water needs in the face of scarcity and an uncertain future.

SOUTH PLATTE AND METRO BASIN ROUNDTABLE GOALS

Encourage implementation of projects

Maximize development of native South Platte supplies

Maintain and promote municipal and industrial conservation and efficiency

Maintain and promote reuse

Maintain and improve irrigated agriculture

Protect and enhance watershed function

Protect and enhance environmental attributes

Protect and enhance recreational attributes

Support collaborative development and management of supply options outside of the South Platte Basin

Utilize scenario planning to better manage uncertainty of future water needs

Broaden South Platte communications, outreach, and education programs

Improve efficiency and effectiveness of water project permitting
Municipal, industrial, and agricultural gaps are projected to occur in all scenarios; the persistent nature of the gaps point to a need for projects that provide firm yield, and meeting demand will need to be balanced with environmental and recreational needs.
The Southwest Basin has diverse and vibrant communities, varied natural systems, agricultural heritage, exceptional beauty, and extensive recreational opportunities.

KEY ACHIEVEMENTS

A wide variety of projects achieved results that support the Southwest Basin Roundtable’s goals. Water Supply Reserve Fund grants supported:

- Agricultural projects ranging from infrastructure improvements to investing in innovative management practices, measurement stations, and reservoir studies.
- Municipal and industrial projects ranging from water supply studies to waterline extensions and improvements, development of raw water supplies for municipalities, and infrastructure development to previously unserved communities.
- Environmental and recreational projects, including stream management plans and restoration.
- Innovative and multipurpose action-driven projects that support multiple goals in the Southwest Basin.
Basin Overview

The Southwest Basin consists of nine subbasins of the San Juan and Dolores Rivers. It covers an area of approximately 10,169 square miles in the southwest corner of Colorado. Both rivers have their headwaters in the San Juan Mountains. The Dolores River forms the northerly portion of the Southwest Basin, flowing generally northwest and crossing the Utah state line near Gateway, Colorado. Its biggest tributary is the San Miguel River, which extends from the vicinity of Telluride along the southwest perimeter of the Uncompahgre Plateau to its confluence with the Dolores River in western Montrose County. The terrain of the Dolores River Basin consists of high plateaus with deeply incised canyons and dry arroyos. Elevations in the Dolores River Basin range from about 14,200 feet near the Dolores River headwaters to 4,100 feet at its confluence with the Colorado River in Utah.

San Juan River flows southwest into Navajo Reservoir, which straddles the Colorado-New Mexico state line. Downstream of the reservoir, it continues through New Mexico and Utah before reaching the Colorado River. Six streams flow south and west out of Colorado before they join the San Juan River: the Piedra, Pine, Animas (including the Florida River), La Plata, and Mancos Rivers and McElmo Creek. Elevations in the San Juan River system range from more than 14,000 feet in headwater areas of the Animas and Los Pinos Rivers down to approximately 4,600 feet near the Four Corners area. The San Juan Basin is characterized by rugged terrain, including mesas, terraces, escarpments, canyons, dry washes (arroyos), and mountains.

Basin Facts

- Average annual precipitation ranges from more than 40 inches per year in the San Juan Mountains to less than 13 inches per year near the Colorado-Utah state line.
- The Dolores/San Juan/San Miguel Basin generally has high-quality surface water except in the headwaters of the Animas River near Silverton and the Dolores River near Rico due to mining impacts.
- The Dolores River accumulates naturally occurring salt as it traverses the Paradox Valley, which is actively managed by BOR.
- Locals and visitors enjoy a variety of recreational activities in the basin, including hiking, skiing, soaking in hot springs, and exploring the lands of ancient peoples.
- The Upper San Juan River and its tributaries flow through the Ute Mountain Ute Reservation and the Southern Ute Indian Reservation.
- Agriculture and ranching dominate the lower elevations of Dolores, San Miguel, and Montrose Counties while tourism and recreation have become more prevalent in the region as the Animas, Piedra, Dolores, and San Miguel Rivers offer both fishing and rafting opportunities.
- Natural gas and oil have been extracted from deep wells within the Dolores/San Juan/San Miguel Basin for years, and a recent interest in coalbed methane gas has resulted in a new energy boom in the region.
- SUIT and UMUT are pursuing viable options to develop their unused federal reserved water rights. Colorado has water rights settlements with both Tribes.

For more information on the Southwest Basin, see the Basin Implementation Plan available at: Basin Implementation Plans | Colorado Department of Natural Resources

The Southwest Basin is comprised of nine individual subbasins, each with its own unique hydrology. Water users in the La Plata Subbasin, for example, routinely experience shortages, whereas streamflow supplies in the Animas Subbasin can meet demands year-round. Locals and visitors enjoy a variety of recreational activities in the basin, including hiking, skiing, soaking in hot springs, and exploring the lands of ancient peoples. The SUIT and UMUT, the only two Tribal reservations in Colorado, call the Southwest Basin home. Lake Nighthorse, part of the Animas-La Plata Project, stores water for use by SUIT, UMUT, Navajo Nation, and municipalities in both Colorado and New Mexico.
In 1992, the San Juan River Basin Recovery Implementation was established with the goal of fully recovering the Colorado pikeminnow and razorback sucker in the San Juan River Basin. The program manages non-native fish populations, restores habitat, and works with BOR to manage Navajo Reservoir releases to improve streamflow.

In 2013, the Animas-La Plata Project was completed. The project was authorized in 1968 under the Colorado River Basin Project Act and incorporated into the Ute Indian Water Rights Settlement Act in 1988. It provides diversion and storage of flows for use by both SUIT and UMUT and municipalities in both Colorado and New Mexico.

In 1988, the Colorado Ute Indian Water Rights Settlement Act settled the reserved water-rights claims of SUIT and UMUT concerning quantity, priority, and administration on all streams that cross the two Tribes’ reservations. More information on Tribal water rights can be found in Chapter 3.

U.S. Bureau of Reclamation. Projects and Facilities: Animas-La Plata Project
Basin Challenges

The Southwest Basin faces several water resources challenges to balancing agricultural uses while supporting environmental and recreational values—all of which support the economic and aesthetic values that support a high quality of life. Water quality is also a major concern. Each Tribal area and subbasin represents distinct communities and landscapes with its own social, economic, and environmental values, challenges, and opportunities. Challenges identified in the BIP are:

**KEY CHALLENGE**

**AGRICULTURE**

- The Cortez and Dove Creek area traditionally has had a strong agricultural community that was supplemented by energy production. Recent population growth due to retirees moving to the area has caused urbanization of these irrigated lands and altered traditional agricultural practices.
- Drought has severely impacted available supplies in McPhee Reservoir, which is a part of BOR's Dolores Project. Portions of the McElmo Subbasin rely on the return flows of this transbasin water and may be impacted in the future by changes upstream due to climate change or changes in agricultural practices.
- Persistent drought conditions and new drought projections do not suggest improvement to existing agriculture demand gap and show increased gaps.

**WATERSHED**

- Drought and large, uncontrolled forest fires have had a devastating effect in many areas of the Southwest Basin. Forest health initiatives are needed for community wildfire protection, increased watershed resiliency, water quality protection, and source water protection planning, and to mitigate negative impacts from past forest management practices.
- A full understanding of environmental and recreational water supply needs continues to lag behind the understanding of agricultural, municipal, and industrial water supply needs within most areas of the Southwest Basin.
- Providing sufficient water supplies for environmental and recreational uses while allowing consumptive use to continue.
- Drought and warming climate trends have an impact on the number of recreation days on the river, significantly affecting businesses that depend on river recreation. These same trends have a significant impact on aquatic habitat, particularly cold-water fisheries, as stream temperatures increase both in magnitude and duration.
- Balancing the needs of communities and water users with environmental protection.

**MUNICIPAL AND INDUSTRIAL**

- The Pagosa Springs-Bayfield-Durango corridor is rapidly growing while experiencing areas of localized water shortages. This area is transitioning from oil and gas, mining, and agriculture to tourism and recreation, and to retirement or second-home communities.
- Developing sufficient infrastructure to deliver municipal and industrial water where it is needed is a challenge. Existing reservoirs storing municipal and industrial water lack infrastructure to deliver water to treatment plants and distribution systems.

**COMPACTS, ADMINISTRATION, AND REGULATORY**

- All nine subbasins are tributary to the Colorado River and, therefore, fall under the Colorado River Compact and Upper Colorado River Basin Compact.
- In addition to the Colorado River Compact, the La Plata Subbasin is also subject to the daily requirements per the La Plata River Compact. The La Plata River is over-appropriated, which complicates meeting multiple compact requirements.
- Increasing water scarcity associated with climate change will create additional pressures.
• There is need for consistent improvement of water quality impairment due to historic mining operations, natural geology, water temperature variability, and nonpoint source pollution. The Animas Subbasin is home to the Bonita Peak Superfund Site.

CROSS-SECTOR CHALLENGES
• The Southwest Basin has a mix of recreation and tourism activities, along with a strong desire to maintain agriculture in the subbasins.
• Balancing current water uses and practices with impending drought impacts brought on by a changing climate is a challenge and may affect all sectors of water use.
• Increased population growth in many communities, due partly to increased second home purchases and retirees relocating, puts pressure on water supplies and agricultural urbanization. New residents to the area may lack understanding of water use and supply availability in the Southwest Basin.
• There is uncertainty existing on potential impacts from SUIT and UMUT growing into their full allocations of currently unused water supplies.
• Southwest Basin communities currently rely heavily on grant funding for projects due to the rural nature of the communities.
• Maintenance and replacement of aging water infrastructure is expensive.

Goals and Strategic Vision for the Future

The Southwest Basin goals describe the specific things the basin needs to do to meet its future water-related needs, while the strategic vision considers the goals, challenges, and proposed basin projects to concisely describe a long-term strategy for meeting future basin needs. The Southwest Basin goals are proposed to meet potential future water gaps with a planning horizon of 2050. The goals reflect activities completed since the 2015 BIP, new challenges faced by water users in the Southwest Basin, and new areas of interest users in the Southwest Basin, and new areas of interest.

Balance all needs and reduce conflict
Maintain agricultural water needs
Meet municipal and industrial water needs
Meet recreational water needs
Meet environmental water needs
Promote healthy watersheds
Manage risk associated with the Colorado River Compact
Strategic Vision for the Future

Southwest Basin goals and strategic vision are centered around balancing water needs of all sectors and reducing conflict.
Climate-impacted scenarios project a reduction in flows and available water; projects that provide firm yield and increased conservation and efficiency are crucial for balancing future water needs.
The Yampa-White-Green Basin has a rich agricultural heritage and vast natural landscapes that support a strong tourist economy.

**KEY ACHIEVEMENTS**

Numerous benefits achieved through diverse project successes, including:

- Yampa Integrated Water Management Plan
- White River Integrated Water Initiative
- Agricultural Improvement Projects
- White River Algae Research Project
**Basin Overview**

The Yampa-White-Green (YWG) Basin covers approximately 7,660 square miles in northwestern Colorado. The basin landscape is diverse and includes steep mountain slopes, high plateaus, canyons, and broad alluvial valleys. The forested mountain ranges are covered with snow in the winter, which melts into streamflow during spring and summer. Livestock, grazing, and recreation are the predominant land uses.

The Yampa River is the largest tributary to the Green River, originating in the Park, Gore, and Flat Tops Ranges and flowing generally north to Steamboat Springs, then west for more than 140 miles to its confluence with the Green River a few miles upstream of the Colorado-Utah state line. The lower end of the Yampa River flows through Dinosaur National Monument, where it becomes a meandering desert river. The White River Basin lies between the Yampa and Colorado River Basins. The White River’s North and South forks each begin in the highlands of the Flat Tops formation at about 11,000 feet and flow west, meeting near Buford, Colorado. Rising in the Wind River Range of Wyoming, the Green River flows south through the Green Basin in Wyoming, through Flaming Gorge into Utah, and enters Colorado just south of the northwest corner of the state.

The region has a rich agricultural heritage and a strong tourist economy based on snow sports, boating, fishing, and hunting. Environmental assets include wilderness areas, endangered fish species, and vast natural landscapes. The YWG Basin also contains some of the richest deposits of fossil fuels in the nation.

**Basin Facts**

- Average annual precipitation varies from more than 60 inches near Rabbit Ears Pass and more than 40 inches in the Flat Tops to approximately 10 inches near the state line.
- Agriculture is a primary focus in the Yampa Basin. Irrigated acreage in the basin consists primarily of high mountain meadows and cattle ranches in the upper reaches along tributaries and the mainstem of the Yampa River.
- Approximately 60 percent of the irrigated acres in the White Basin are concentrated along the river near the Town of Meeker. The remaining acreage is located along tributaries and spread along the lower mainstem. Grass pasture is the dominant crop, and alfalfa is also grown. These forage crops support cattle grazing and ranching operations, which is a major economic driver.
- Steamboat Springs and Craig are the major population centers in the Yampa Basin, with 12,900 and 8,900 residents, respectively. Rangely and Meeker are the major population centers in the White Basin, with about 2,400 residents each.
- The Green River formation within the Piceance Basin of Garfield and Rio Blanco counties is the most significant deposit of oil shale in the world.
- The Yampa and White Basins contain diverse and rich environmental and recreational resources that support activities such as rafting, kayaking, tubing, fishing, and flatwater recreation. Steamboat Lake is the basin’s only designated Gold Medal fishery.
In the YWG Basin, ranching is a way of life, with grass hay primarily grown to support cattle operations. Steamboat Springs is a popular tourism destination, and its population is expected to grow driven by summer and winter recreational activities. The Yampa, White, and Green Rivers provide critical habitat for the humpback chub, bonytail, Colorado pikeminnow, and razorback sucker. These four endangered fish species are the focus of the Upper Colorado River Endangered Fish Recovery Program.

Water Resources Development Timeline

- **1880**: In 1880, the earliest rights in White River Basin irrigation rights were appropriated, and the first general adjudication was completed in 1889.
- **1922**: In 1922, the seven Colorado River Basin states entered into the Colorado River Compact. This compact allocated the consumptive use of the river between the Upper Basin and Lower Basin. Additional compacts and agreements were developed over time (see Chapter 3).
- **1967**: In 1967, Steamboat Lake was developed by CPW and proponents of the Hayden Power Plant.
- **1974**: In 1974, Elkhead Reservoir was constructed by CPW and Yampa Participants, a consortium of power providers.
In 1980, the Yamcolo Reservoir was completed by the Upper Yampa Water Conservancy District, which also completed the Stagecoach Reservoir in 1989.

In 2005, the Final Programmatic Biological Opinion on the Management Plan for Endangered Fishes in the Yampa River Basin was finalized. The plan promotes the recovery of four listed endangered fish species, which include the bonytail, Colorado pikeminnow, humpback chub, and razorback sucker.

In 2018, the Yampa River experienced its first water rights call due to low water conditions in the lower stretch of the river near Dinosaur National Monument.
Basin Challenges

Key future water management issues for the YWG Basin include gas and oil shale development; addressing water resources needs for agriculture, tourism, and recreation; and protecting endangered species. Challenges identified in the BIP are:

### Agriculture
- Agricultural producers would like to increase irrigated land by 14,805 acres but lack finances to do so.
- Agriculture in the White Basin does not have reservoir/supplemental supplies, which can cause late-season shortages.
- Agriculture is vulnerable to climate change due to the expected changes in hydrology and the increase in crop irrigation requirements due to warming temperatures.

### Watershed
- Stream temperatures and increasing nutrient loads are emerging water quality concerns. Increasing stream temperatures on the Yampa River have resulted in a 303(d) impaired stream listing. Benthic algae in the White River can reach uncharacteristic and nuisance levels.

### Municipal and Industrial
- The high degree of uncertainty surrounding oil shale development and related water demands are a challenge.
- In the Yampa Basin, the planned closure of coal-fired electric generation stations is a serious economic and social challenge.

### Compacts and Administration
- While the population is rapidly growing in the Steamboat Springs area, the YWG Basin as a whole is not developing as quickly as other portions of the state. Concerns have arisen over protecting existing uses and future uses in the basin, especially in the event of compact administration.

### Cross-Sector Challenges
- Agriculture, tourism, and recreation are vital components of this basin’s economy. As the needs of communities and industry grow, competition among sectors could increase.
- Wildfire frequency and severity is increasing in the western United States. Because wildfires have the potential to impact a watershed’s water quality and quantity, water managers are joining efforts to improve forest health and create more wildfire-resistant landscapes.
- Drought impacts and their effects, potentially exacerbated by climate change, have continued to grow (the mainstem of the Yampa River saw its first-ever senior water rights call in 2018). It now appears this will be a major focus of basin water planning, particularly with respect to compact matters and possible new Colorado Basin initiatives.

### Key Challenge
Balancing traditional economic activities with emerging consumptive demands while meeting environmental and recreational needs is the overarching challenge in the basin.

<table>
<thead>
<tr>
<th>Agriculture</th>
<th>Watershed</th>
<th>Municipal and Industrial</th>
<th>Compacts and Administration</th>
</tr>
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**Continued implementation of a successful Upper Colorado River Endangered Fish Recovery Program is vital to ensuring protection of existing and future water uses.**

See Chapter description of Endangered and Threatened Species Recovery Programs for more information.
Chapter 4: Basin Context

Goals and Strategic Vision for the Future

YWG BASIN ROUNDTABLE GOALS

Protect the YWG Basin from compact curtailment of existing decreed water uses and some increment of future use

Restore, maintain, and modernize water storage and distribution infrastructure

Protect and encourage agricultural uses of water in the basin within the context of private property rights

Improve agricultural water supplies to increase irrigated land and reduce shortages

Identify and address municipal and industrial water shortages

Quantify and protect environmental and recreational water uses

Maintain and consider the existing natural range of water quality that is necessary for current and anticipated water uses

Develop an integrated system of water use, storage, administration, and delivery to reduce water shortages and meet environmental and recreational needs
Strategic Vision for the Future

Meeting future water needs and implementing projects are the primary strategies of the YWG Basin Roundtable to achieve basin goals. To explore possible options for meeting future water needs, the basin roundtable modeled three alternative management strategies. They are:

- **Alternative 1:** Agricultural Efficiencies
- **Alternative 2:** New Releases from Existing Storage
- **Alternative 3:** Enlarged/New Reservoirs

Results from the model are intended to help the YWG Basin Roundtable understand the trade-offs of the alternative management strategies. The details in the 2022 BIP can help guide stakeholders on implementation to maximize benefits and minimize risks.

In addition, project implementation is a key strategy. Through partnerships and multi-benefit projects, the basin can firm existing supplies, develop new supplies, and enhance environmental and recreational attributes.

The Yampa-White-Green Basin Roundtable will promote a sustainable and diversified economy while supporting a healthy river.
Climate-impacted scenarios present a reduction in flows and available water; stakeholders will need strategies to mitigate/adapt to the increased risks.
The BIPs were developed in a collaborative process by basin stakeholders and focused on the current and future water needs of each basin, the vision for how individuals and organizations can meet future needs, and the goals and projects that provide a pathway to success. The content developed in the BIPs inform the Water Plan update. The basin-specific challenges, goals, and strategic visions roll up into a set of common themes that highlight issues applicable to multiple basins or even statewide. Because our basins are all different, the BIPs included their own unique challenges, goals, and strategic vision elements that reflected local conditions.

Common Themes

The basins' challenges highlight their most important concerns moving into the future. The information below summarizes the common challenges, goals, and future visions described in the BIPs. The information from the BIPs inform Water Plan Chapters 5 and 6, which present a holistic view of the shared challenges and tools for mitigating risk across the state and present specific actions that can be accomplished during this Water Plan cycle.

Basin Challenges

Balancing future risk while meeting needs across sectors and complying with interstate compacts and agreements is an important concern. Competition for limited supplies contributes to future risk. Solutions for meeting challenges include water storage, efficiency and conservation programs, and flow enhancement and maintenance tools. A resilient planning approach can result in equitable solutions to balancing future water-related risk.

Uncertain climate conditions present a broad range of challenges. Climate change may result in extended drought and aridification that affect water users in different ways, such as reduced streamflow, changing growing seasons, and altered supply and demand patterns. Reducing climate change risk will require collaborative solutions across all four action areas – Robust Agriculture, Vibrant Communities, Thriving Watersheds, and Resilient Planning.

Loss of agriculture and reduction in irrigated acres due to water transfers and urbanization is a concern for many basins. Agriculture is often an important value in the community and contributes to the local economy. The use of tools such as Collaborative Water Sharing Agreements (CWSA) can help achieve a balance between maintaining agriculture and meeting other water uses. The Robust Agriculture action area focuses on the economic viability and resiliency of the agricultural sector.

Funding and development of water projects is a significant concern for many stakeholders. Communities and other stakeholders face increased costs for water, and some lack funding for project implementation, which impacts their ability to mitigate future risk. In addition, inefficient regulatory processes centered on permitting present an additional hurdle that can increase costs and uncertainty for project implementation. Collaboration, multi-purpose projects, and creative funding strategies can help overcome this challenge. All four action areas address this multi-sector challenge.

Watershed and forest health is a key issue across the state. Impacts from disturbances or natural disasters such as wildfires, floods, and beetle kill affect our ecosystem and water supply. Our forest health, water quality, and endangered species protection and recovery programs are impacted by these disturbances. Flow enhancement programs, watershed planning, natural hazard planning, restoration projects, CWSAs, and environmental programs help address watershed health challenges. The Thriving Watershed action area focuses on addressing the issue.

BASIN IMPLEMENTATION PLAN

SUMMARY

Colorado Water Conservation Board

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Basin Goals and Strategic Vision

The goals identified by basin roundtables describe specific ways in which needs across all water use sectors will be met, and their strategic vision provides a broad view of how basin goals will be reached. Many of the goals and strategic visions presented in the BIPs had common themes and characteristics. Chapter 5 describes the types of common or shared tools that can be used in achieving the goals and strategic vision of the basins.

### COMMONALITIES AMONG BIP GOALS AND STRATEGIC VISIONS

- Meet future municipal and industrial water needs
- Sustain agriculture and a productive agricultural economy
- Maintain, protect, and restore healthy rivers, lakes, wetlands, watersheds, and forests
- Implement projects that reduce the risk of future shortages and seek, where possible, multi-purpose opportunities
- Implement water conservation and efficiency strategies
- Maintain and improve water quality
- Enhance resiliency by considering climate change, planning for uncertainty, and addressing vulnerabilities
- Restore, maintain, and modernize critical water infrastructure
- Broaden education, outreach, and participation
- Collaborate and build partnerships
- Comply with interstate compacts and agreements

### Differences

Local and regional conditions drive specific challenges and needs for each basin. The information below summarizes some of the local drivers and challenges that influence the differences in goals and strategic visions described in the BIPs.

#### Source of Supply:
Sources of water supply and hydrology are unique to each basin. For example, the Rio Grande and Republican Basins are challenged by declining groundwater supplies, and the Arkansas Basin faces challenges from very limited surface water supplies as well as declining groundwater supplies. Eastern slope basins rely on native supplies and TMDs from western slope basins.

#### Future development concerns:
Population growth and associated increased water demand and risks to agriculture are a big concern on the eastern slope and drive eastern slope goals, strategic visions, and projects. Future growth is a concern in western slope basins (though not as acute), as are concerns about eastern slope growth and the impact on western slope supplies and ecosystems.

#### Industrial Demands:
The significance of industrial water demand and the future of industry varies across the basins. The YWG Basin faces an economic and social challenge due to the closure of its coal-fired power generation facilities, whereas other basins’ industrial demand may be relatively small and somewhat stable in the future.

#### Interstate Compacts:
Various decrees, compacts, and agreements govern the major interstate streams in Colorado. A summary of Colorado’s interstate compacts and agreements are summarized in Chapter 3.

The Water Plan’s foundation is in its grassroots approach and basin-developed input. Common themes and differences across basins inform the overarching challenges the state faces, solutions to address them, and actions.
Potential Costs of Basin Identified Projects

An ongoing critical data need has been to develop a better understanding of the full scale of costs related to water projects that would help Colorado meet its future water demands. Knowing the scope of the costs helps CWCB better prepare for incoming grant and loan requests to support these projects. Prior summaries of expected basin-identified project costs were cited in the 2015 Water Plan, but they did not reflect the full scope of project costs, as many cost details were not available and were flagged as "forthcoming."

Efforts to Enhance Project Cost Data

Basin roundtables conducted stakeholder outreach during the 2022 BIP update process to gather and update project cost data as well as 20 other data sets for projects identified by stakeholders in each basin. A wide variety of projects were identified by basin stakeholders. Projects reflect all sectors of water use and include agricultural, environmental, municipal, and recreation projects. Project implementation timelines also varied. Some projects are almost ready to be started, some are being planned for implementation in the foreseeable future, and some projects are highly conceptual and may be implemented in the distant future and perhaps differently than currently imagined (if at all). Some of the identified projects will use additional water, but many projects will not, such as water conservation programs, stream restorations, education and outreach, and studies. Projects identified by the roundtables generally focused on infrastructure, restoration activities, and programs that reduce the risks associated with potential future water shortages and changes in hydrology. Consistent with the intent of the database to focus on water supplies, water distribution, and wastewater projects were not included. Potential costs for environment/recreation enhancements and aging agricultural infrastructure projects are included to the extent that stakeholders provided cost data, but additional projects in these areas are likely needed.

Basin roundtables categorized local projects using an initial "tiering" approach that aimed to demonstrate the readiness of projects. The CWCB's online Project Database archived the initial data, and the database allows for simple sorting of projects based on the level of project readiness as determined by the time the project states it may be advancing and the completeness of required data fields. Projects are listed as "ready," (1 year) "short-term" (2-5 years), "mid-term" (5-10 years), or "long-term" (longer than 10 years). Because projects listed may be conceptual or may otherwise not advance, this tool is only intended as a high-level planning tool to understand potential funding needs and is expected to receive minor updates annually.

Some projects listed in the Project Database are only conceptual, and they range in readiness level. Projects listed in this database are also not guaranteed to be approved or funded. This is intended as a planning tool to look at a range of potential ideas. Additionally, projects do not generally include other basin needs that touch on things like water treatment, wastewater, etc.

Basin Priorities can align projects that benefit all stakeholders but funding is a challenge.
— Steve Anderson, CWCB
Summary of Cost Data

Cost estimates of basin projects from the past and current Water Plan show a consistent need for about $20 billion in funding—providing justification for ongoing funding needs for CWCB to help advance these efforts. However, only some of total funding need will come to CWCB. For example, not all of the potential projects identified (especially those that are conceptual) may advance, other grant funds (e.g., federal) may be pursued, and customer fees or private investment will fund a portion of the viable projects.

Matching requirements for grants ensure that only a portion of the total costs funded through grants will be provided by CWCB (see Chapter 3 for an explanation of “Colorado’s Water Funding Needs”).

While it was not possible to identify every project necessary to meet Colorado’s future water demands, the work of the basin roundtables and stakeholders represents a large step forward in better understanding costs of potential future projects. The basin roundtables and stakeholders identified more than 1,800 potential future projects.

Project Costs Identified in the Basin Implementation Plans

<table>
<thead>
<tr>
<th>BASIN</th>
<th>COSTS OF POTENTIAL PROJECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arkansas</td>
<td>3,636,800,000</td>
</tr>
<tr>
<td>Colorado</td>
<td>4,083,500,000</td>
</tr>
<tr>
<td>Gunnison</td>
<td>1,524,800,000</td>
</tr>
<tr>
<td>North Platte</td>
<td>6,400,000</td>
</tr>
<tr>
<td>Rio Grande</td>
<td>164,500,000</td>
</tr>
<tr>
<td>South Platte / Metro / Republican</td>
<td>9,869,500,000</td>
</tr>
<tr>
<td>Southwest</td>
<td>791,900,000</td>
</tr>
<tr>
<td>Yampa / White / Green</td>
<td>667,300,000</td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td><strong>$20,744,700,000</strong></td>
</tr>
</tbody>
</table>

The CWCB promotes and plays a role in funding projects throughout the state. The State of Colorado does not build water projects, and instead partners with local water providers and stakeholder groups to develop and implement water projects. The CWCB provides funding in the form of grants and loans to entities like water providers, watershed groups, and ditch companies, who are the key stakeholders that develop water projects. More information on CWCB’s role in funding projects and funding challenges is in Chapters 3 and 5.

Breakdowns of project data for each individual basin are in the BIPs.

Number of Projects in each Basin

While single purpose projects play an important role in meeting water needs, CWCB encourages collaborative projects that serve several purposes. Half of the projects identified in the BIPs are multi-purpose.
THERE IS A VERY REAL RISK OF PERMANENT DRY UP OF AGRICULTURAL LAND... WHEN WE SEE THE MARKET PULL, WATER IS SO VALUABLE YOU’LL FIND THE MARKET IS DRIVING THOSE DECISIONS BEFORE POLICY AND POLITICS CAN CATCH UP.

— KATE GREENBERG
Colorado’s Commissioner of Agriculture
Colorado water users face a wide variety of water-related challenges and risks. Some of these are sector specific (e.g., agricultural, environmental, or municipal) and may be more regionally or locally focused; however, even local issues can have cascading impacts that affect all sectors and Colorado as a whole. Some examples include:

**AGRICULTURAL DRY-UP**
The purchase and permanent transfer of agricultural water rights — widely known as "buy and dry" — impacts Colorado's statewide economy and food security as well as local, rural communities.

**ENVIRONMENTAL CONCERNS**
A unique and outstanding characteristic of Colorado is its natural environment. Water quality, watershed health, and ecosystem resilience challenges must be addressed considering increasing water demands and a changing climate, which could lead to habitat degradation. This risk has the potential to increase if agricultural, municipal, and industrial water needs clash with environmental and recreational water needs.

**MUNICIPAL WATER SUPPLY GAPS**
The Technical Update projected future water supply gaps for municipalities if they do not implement strategies and projects to meet future demands. Both large and small municipal water providers will be challenged to meet potential gaps. Some small communities adjacent to larger municipalities are faced with high population growth but lack the water supply to support it.

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[Link to CWCB Website]
Identifying and understanding sector-specific challenges is critical for reducing risk and meeting future water needs.

Climate Changes and Climate Extremes
All water use sectors. The underlying analysis in the Water Plan highlights

Water Quantity

Water Quantity/Water Quality Nexus
Low flows can create or exacerbate water quality problems by:
- Raising water temperature, which decreases dissolved oxygen while raising the metabolic rates of fish; increases solubility of salts, metals, and other toxins; and promotes algal blooms
- Increasing salinity as groundwater becomes a larger proportion of streamflow
- Increasing concentrations of total suspended solids or pathogens as flow of the receiving streams becomes smaller

CLIMATE-RELATED IMPACTS
Water Quality

As the economy and population grow and land uses change, water quantity demands will increase, and water quality could be stressed by factors such as nonpoint source pollution, elevated stream temperatures, post-wildfire impacts to water quality, and other impacts of climate change. Currently, approximately 30 percent of Colorado’s streams and lakes do not meet applicable water quality standards for one or more classified uses (agriculture, water supply, recreation, or aquatic life).

Waters that do not attain water quality standards (also called impaired waters) affect our ability to use water for domestic water supply, agriculture, aquatic life, and recreation. They also adversely impact water and wastewater providers’ ability to treat water for drinking, or to discharge back into streams, respectively. The most common causes of river and stream impairments include manganese, arsenic, and sulfate, and temperature is a growing concern. For lakes and reservoirs, the leading causes of impairment include arsenic, selenium, and temperature. Notably, new or revised water quality standards are continually adopted by WQCC through established regulatory procedures as emerging contaminants are identified and as science changes our understanding of impacts of specific parameters on human health and aquatic life. When streams and lakes do not meet water quality standards, they are identified as impaired and WQCD is required to develop a pollutant budget called a total maximum daily load (TMDL). This pollutant budget is the foundation for restoration planning and identifying actions necessary to improve water quality so that water quality standards are attained. TMDL development and restoration planning are informed by stakeholder input. However, there are times when more immediate water quality actions are needed. For example, CPW may authorize emergency closure of fishing waters in the state when it is determined that environmental conditions in these waters are such that fishing could result in unacceptable levels of fish mortality. Low streamflows and dissolved oxygen levels as well as high stream temperatures are some of the criteria used by CPW to make decisions about mandatory or voluntary fishing closures on rivers and streams.

Creating a balance between increasing quantity demands and water quality protection and restoration requires ongoing dialogue with all Coloradans and collaboration at all levels of government. Traditionally, Colorado has managed water quality and quantity separately based on different constitutional, statutory, regulatory provision, and the mission and function of individual agencies. For example, as a policy agency with no regulatory authority, water quality planning and management is not under the direct control of CWCB. While there is significant coordination across agencies, each state agency is often simultaneously working on multiple priorities that are critical to its mission. Continued investment in ongoing partnerships, as well as finding new ways to coordinate that help align work and create synergies with projects and funding, will be key to creating mutually beneficial policies and practices.

Funding Shortfalls

Investing in long-term and resilient supply, delivery, and environmental restoration projects is critical to Colorado’s future. Colorado faces challenging fiscal conditions for water projects. Financing long-term, sustainable water supply and infrastructure projects requires a collaborative effort. Funding is also needed to support sustainable management strategies for reducing demand. Local water providers often use customer water rates and tap fees as the primary source of funding.

Approximately 30 percent of Colorado’s streams and lakes do not meet applicable water quality standards for one or more classified uses.

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Tapping into Water Quality

The CWCB’s role as a policy agency focuses largely on water resources and does not play a regulatory role in monitoring or enforcing water quality. Water quality regulations for stormwater runoff, streamflow, reservoirs, treatment plants, and drinking water fall to CDPHE’s WQCD and WQCC. The CWCB partners with CDPHE on specific projects and initiatives where water quality and water quantity issues overlap.

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Funding Shortfalls


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WE CAN’T FUND ALL THE PROJECTS WITH GRANTS SO WE NEED EDUCATIONAL EFFORTS TO HELP LOOK AT ALL THE WAYS TO FUND THE PLAN.

— ROBERT SAKATA, CWCB
where the end user is directly connected with costs and investments; however, smaller communities bring in less money from these rates and fees, which puts them at a disadvantage in generating revenue. Environmental and recreation projects are needed, but funding assistance is often required for planning and implementation. Natural hazards from wildfire, drought, and flooding events are costly, both in the short term and years after a disturbance. Preparedness is also costly. For example, about 10 percent of Colorado’s forests are estimated to need $4.2 billion to address forest health, wildfire risk, and threats to forested water supplies. That’s on top of water project needs identified in the Water Plan and other agency needs for issues like regulation and enforcement. Adequate funding for all sectors of Colorado’s water projects will require pooling of funds and resources. Multi-purpose projects can engage many different types of stakeholders and offer the potential to use multiple funding sources. Chapter 3 provides more information on funding needs and funding sources for water projects.

Aging infrastructure

The expected volume of water needed to meet Colorado’s future municipal, agricultural, and environmental needs is dependent on existing infrastructure. Part of those needs will go unmet if current conveyance, treatment, and storage systems are impaired. Replacing aging infrastructure continues to be a high priority that will need support from private investment, rate payers, and other sources. Infrastructure improvements are not only needed in the municipal sector, but agricultural as well. A recent survey by the Colorado Cattlemen’s Association found that the condition of irrigation water delivery infrastructure was the second-most important concern of agricultural producers after water shortage concerns. Improving delivery infrastructure is costly. Additionally, updates to aging infrastructure provide an opportunity to improve diversion efficiency while also mitigating hazards to the recreating public and restoring ecosystem health and connectivity.

Regulatory and Legal Constraints

Federal, state, and local regulatory and legal requirements sometimes create project development and implementation challenges. Some options to meet water supply needs are very complex and need detailed planning and technical analyses to adequately address federal, state, and local requirements. Project permitting can be very expensive and time consuming due to the complexity of projects, the challenges in understanding and reducing environmental impacts, and the condition of many aquatic systems. Colorado’s legal framework for water rights can also create challenges for water users. Water rights proceedings are conducted through the judicial system and can be costly and time consuming for both water project proponents and participating parties that could be impacted. Strategies to reduce risk (e.g., rainwater harvesting, improved conveyance efficiencies) can raise water rights issues. Creating regulatory, legal, and process efficiencies and flexibility while maintaining the protections that regulatory processes provide will be a continuing challenge that affects all water use sectors.

Cross-agency Permitting Handbook

Cross-agency Permitting Handbook, published in 2017, helps project proponents consider regulatory issues in initial planning phases so that projects meet permitting requirements more efficiently. The handbook was developed in partnership with several agencies, including CWCB, CPW, and CDPHE.

— DAN GIBBS, Executive Director, Department of Natural Resources


Forest Health

Most of Colorado’s water supply comes from forested watersheds that are home to a wide variety of plant, animal, and fish species and also provide recreational and economic benefits. Colorado has opportunities to improve and maintain healthy forests. Adaptive forest management practices need to be implemented to protect water supplies and improve the overall health of Colorado’s watersheds. Pre-wildfire planning and mitigation efforts, which may include implementation of nature-based solutions, are opportunities to reduce risk and lower the costs associated with potential threats to forest health. Our capacity to predict potential effects that wildfire and climate change may cause in our forests is limited, and more research is needed to understand potential impacts to forest ecosystems and water supplies. Forest health is described further in Chapter 6, Thriving Watersheds.

Inclusive Public Engagement

Risks associated with important issues such as climate change, potential future water shortages, and natural hazards require that Coloradans be educated and ready to act on water-related challenges. Coloradans must collaborate on adaptive planning and ensure education and outreach efforts are inclusive. This will provide Coloradans the opportunity to understand what is at stake and participate in equitable, diverse, and inclusive solutions.

Data and Research Gaps

A deeper understanding of climate change impacts and how to use science and data to inform decision making is needed across every sector. In many cases, gaps exist in data collection, storage, and accessibility that, if addressed, could better inform actions.

In the future, Colorado will need to find ways to balance risk and maximize benefits by focusing on collaborative efforts, projects, and strategies that consider the needs of multiple users. This will be especially pertinent as demands increase and as already-scarce supplies are more fully used. Building resilience, or the ability to quickly recover from a disruptive event or disturbance without loss of services, is crucial for reducing risks in an uncertain future.

RESPONDING TO RISKS ACROSS ACTION AREAS

The Water Plan focuses on the four action areas of Vibrant Communities, Robust Agriculture, Thriving Watersheds, and Resilient Planning. The areas are interconnected, and many challenges span the four action areas and drive how the Water Plan will work to shape Colorado’s water future.
“Tools” are strategies and projects typically used to collaborate and meet water needs across Colorado.

Colorado water managers and stakeholders typically use a certain set of tools or solutions to meet water needs. Chapter 5 includes descriptions of these tools. These tools will be useful in completing many actions and achieving the vision for meeting Colorado’s future water needs.

Many tools or solutions are available for meeting current and future water needs and achieving the vision for each of the four action areas. Solutions are implemented at various geographic levels, for a variety of purposes, and by a wide variety of agencies, organizations, and water users. Some solutions are institutional in nature or may be implemented at a statewide level. New legislation, regulatory or policy changes, and education programs are examples of higher-level institutional solutions. Solutions also occur at a very local level, and these may include new storage facilities, efficiency improvements on an irrigation ditch, or implementation of a recreational in-channel diversion water right (RICD) on a stream running through a town.

Solutions can be implemented statewide, at local levels, or anywhere in between. For example, education and outreach programs can be implemented across Colorado or could be focused on a specific municipality. Solutions may be developed by institutions and then implemented by local water users. For example, Colorado’s ISF and natural lake level (NLL) program was created by Colorado’s legislature in 1973, and it is used to preserve and improve the conditions of specific streams and lakes.

A wide variety of tools are described in this section. The accompanying illustration provides some general perspective on the type and scale of tools, but this can vary as noted earlier.
INSTITUTIONAL TOOLS are often implemented at a statewide level or are conceptual strategies that can be applied to nearly any challenge. These tools may address significant statewide barriers to achieving water-related goals, enhancing collaboration, and supporting public knowledge of water issues.

PLANNING TOOLS are frequently implemented on a regional level by stakeholder groups, water conservancy districts, or other regional organizations. Regional planning solutions often rely on decision support tools and/or collaborative processes to creatively address competing water needs.

ON-THE-GROUND TOOLS are projects that local water managers use to deal directly with water at a local level. These projects are implemented at a variety of scales by water providers, watershed groups, ditch companies, and in some instances, state agencies.
The tools described below are proven strategies that agencies, water users, and stakeholders implement to overcome challenges.

PUBLIC OUTREACH AND EDUCATION

EXAMPLES

Water Educator Network.

Public survey

Public Opinions, Attitudes, and Awareness about Water in Colorado: 2021 Survey and Focus Groups
Chapter 3 provides more information on how CWCB works with state agencies and other partners on policy and regulatory issues.

**FUNDING**

Many existing state funding sources and programs can assist in meeting Colorado's long-term needs. The CWCB's grants and loan program funds infrastructure development, studies, environmental restoration, and recreation enhancement projects. Funding awards emphasize regional, multi-purpose collaborative, and multi-benefit projects, and projects that consolidate services where practical, feasible, and acceptable. Although CWCB's grants and loan programs cannot solely meet the state's financial water needs, they can help bridge funding gaps when combined with other sources.

The CWCB recognizes that water providers are responsible for their short- and long-term capital investments, which include consumer incentives for conservation and efficiency, operation and maintenance costs, and customer base. Revenue bonds and/or Environmental Impact Bonds issued by water providers are mechanisms available to finance water infrastructure investments, including large-scale investments in turf replacement and other water use efficiency and conservation incentives. Customer water rates and tap fees could be the primary source of funding where the end user is directly connected with the costs and investments. Water providers can seek collaborative, multi-purpose projects, which provide opportunities to combine financial resources and solve complex water supply challenges.

Funding can be raised through public initiatives and through water conservancy and conservation districts. In addition, state and federal stimulus funding can help meet the needs of water users and stakeholders. Chapter 3 includes a more detailed description of CWCB and other sources of funding that can be used to meet water needs in all sectors of use.

Chapter 6 provides examples of actions partners can take to implement the Water Plan and the ways actions map to the five major funding categories of the Colorado Water Plan Grant Program.

**POLICY AND REGULATORY CHANGES**

the state's pressing water resources issues. Policy and regulatory changes

- **Non-functional turf:**


- Water efficiency in comprehensive plans: HB 20-1095 requires local jurisdictions to incorporate water efficiency into their comprehensive plan if that plan contains a water element.

- More efficient fixtures and appliances: HB 19-1231 added requirements for energy and water efficiency for fixtures and appliances sold in Colorado.

- Additional uses for recycled water: CDPHE's recent Regulation 84 changes now allow for reclaimed water to be used for crop and tree irrigation, edible and non-edible hemp irrigation, toilet and urinal flushing, and oil and gas operations, in addition to many other previously approved uses.

- Rulemaking for DPR: In October 2022, WQCC took preliminary action to incorporate DPR rules into Colorado's Primary Drinking Water Regulation (Regulation 11). The new rules set minimum standards and oversight for DPR to ensure consistency and ensure a thorough public outreach process for new projects. Through several CWCB grants, varied groups of stakeholders, including a national expert panel, created a DPR regulatory framework for Colorado, which led to the 2022 rulemaking. The revised regulation is expected to become effective in early 2023.

- Graywater reuse: WQCC adopted graywater control regulations (Regulation 86). As part of CDPHE's triennial review, a stakeholder process for gathering feedback on rulemaking began in 2022.

- Allowance for rain barrels: HB 16-1005, passed in 2016, allows single-family residences to install two rain barrels up to 110 gallons total.

- Agricultural Water Protection Water Right: HB 16-1228 allows the owner of an agricultural water right to change the use of that right and lease, loan, or trade up to 50 percent of the historical consumptive use to another water user for a new use.

- Instream flows: HB 20-1157 enhanced use of loaned water on instream flow reaches on a temporary basis. The CWCB conducted rulemaking on steps for reviewing and accepting loaned water.

- Instream flows: HB 20-1159 allows the State Engineer to confirm ISFs are subject to existing uses not previously confirmed by court decree.

- Instream flows: HB 20-1037 allows CWCB to augment streamflows with water previously decreed for augmentation.

- Instream flows: SB 18-170 provides a water court process by which releases may be made from a reservoir and protected for mitigation purposes under a CWCB approved fish and wildlife mitigation plan.

Statutory and regulatory changes can take time to occur. For example, legislation can potentially take multiple sessions of the General Assembly to pass, depending on the scope and content of legislation and other legislative priorities. Legislative, policy, and regulatory changes require votes or decisions by multiple people, and sometimes agreement can be hard to reach. Nonetheless, policy and regulatory changes are an important tool for meeting Colorado's current and future water challenges.

"THE CERTAINTY, RESILIENCY, AND SECURITY FOR COLORADO IS INCREDIBLY IMPORTANT AND IS REFLECTED IN ALL THE WORK WE’RE DOING."

— REBECCA MITCHELL, CWCB Director
COLLABORATION GROUPS

Collaboration through inter-agency and interdisciplinary approaches that define clear roles and responsibilities can help in prioritizing water issues from planning to implementation. The Water Plan identifies the need to address risks to water supply and watershed health with coordinated planning across boundaries. Regional and local, place-based collaborative groups are a vital component to successfully approaching these multi-scale efforts.

While there is significant diversity in the forms and functions of Colorado collaboratives, they are generally comprised of people representing government agencies, nonprofits, businesses, or independently working together to decide how to use and manage natural resources such as land and water. There is also a need to expand access to collaborative groups and encourage new membership that better represents the demographic of Colorado communities.

Collaboration often means partners pool their resources and create shared goals, processes, and structures to support their new, joint work. Collaborative groups explore, prioritize, deliberate on, and implement the solutions they have developed together.

Collaboration can be particularly useful for addressing problems that:

• Have too high of a cost for one entity to carry alone
• Cross ownership or management boundaries
• Have high levels of uncertainty, missing information, or are viewed differently by participating stakeholders
• Involve tradeoffs and balancing the needs of different water users
• Fail to be resolved with other approaches, like litigation

The CWCB recognizes the need to strengthen institutional connections to achieve identified actions that are outside of CWCB's direct control. Formal collaboration with other organizations and agencies will help reconcile management strategies and identify mutually beneficial policies and practices.

EXAMPLE

Basin roundtables are important collaborative groups that work together to meet Colorado's water challenges.

AS WE PLAN FOR OUR FUTURE IN COLORADO WE MUST RESIST ANY TEMPTATION FOR OUR COMMUNITIES TO BE PITTED AGAINST ONE OTHER. WE MUST PURSUE A PATH OF COLLABORATION AND SHARED COMMITMENT TO INNOVATION AND PROBLEM SOLVING.

— PHIL WEISER, Colorado Attorney General


WATERSHED PLANNING

A watershed is an area of land that connects and drains rain or snow into rivers, lakes, and wetlands. These areas include our snow-capped mountains and forests, which supply water for drinking, agriculture, and industry, and provide recreational opportunities. Watersheds provide vital ecosystem services, such as habitat, carbon sequestration, and water supply filtration. Healthy watersheds with healthy riverscape structure and function are resilient, and resilient ecosystems are able to absorb repeated disturbances (e.g., fires, floods, droughts) and adapt to change without fundamentally changing the services (e.g., flow regime) on which society and the environment depend. The health of forests, streams, and the larger watershed ecosystem is critical to its ability to absorb shocks and stresses.

Watershed management planning is broadly defined as a strategy that provides assessment and management information for a geographically defined watershed. It is a flexible framework that can be applied to a single or range of issues. Successful watershed management requires coordinated planning across political boundaries and organizations. For example, while CWCB does not directly fund forest thinning, stream management planning can leverage funds that include forest thinning to help achieve multiple goals and ultimately enhance river health. Similarly, coordinated efforts that leverage funds to enhance river corridors for recreation can help creatively support both watershed health and recreation.

Watershed management planning is used by a variety of private, public, and non-profit institutions across Colorado to address a range of watershed needs from water quality improvements in urban waterways to enhancing recreational uses in high mountain streams. Effective watershed management planning considers a range of perspectives from diverse voices. Common tools and best practices for evaluating stream health are emerging as the number of watershed plans are developed. While the flexibility to use different tools can be beneficial, the core functions like hydrology, hydraulics, geomorphology, water quality, biology, and recreation are transferable and provide a common link across plans. Finding similarities, identifying successes, and sharing resources can help make planning easier, more effective, and inclusive.

EXAMPLE FRAMEWORKS FOR WATERSHED PLANNING

Stream Management Plans

Integrated Water Management Plans

Upper Culebra Watershed Assessment

The Upper Culebra Watershed Assessment was completed in 2022 to evaluate watershed conditions within the Culebra River basin and develop projects and strategies to address watershed health concerns. The assessment approach is based on community-identified areas of concern and is evaluating a broad range of technical topics from water and streams to forest health. The areas of the assessment include riparian habitat, aquatic habitat, flow regimes, water quality, forest health, geology/geomorphology, infrastructure, and safety and emergency management. In addition, historic and current land use was assessed through one-on-one interviews and historic documents – this allowed for engagement with the acequia community in the region. The assessment received funding from CWCB, Colorado Watershed Assembly, San Luis Valley Conservation Fund, Trinchera Blanca Foundation, Costilla County Conservation District, Sangre de Cristo National Heritage Area, and Colorado Department of Agriculture.

CLIMATE ADAPTATION

INNOVATION

THINK ABOUT CLIMATE MITIGATION AND LOOK THROUGH THE LENS OF CLIMATE ADAPTATION TO HELP CITIZENS AROUND THE STATE BE READY FOR A DRIER FUTURE.

— CELENE HAWKINS, CWCB

Prioritize and incentivize creative projects. Think through the use of every single drop.

— HEATHER DUTTON, CWCB
The population of Colorado is on the rise and projected to increase by 20 percent by 2040, with minorities being 40 percent of the overall population. Inclusive water planning builds resilience to respond to water challenges and advances equitable outcomes for all Colorado communities. Colorado has made progress toward regionally inclusive and collaborative water planning through the 2005 Water for the 21st Century Act, followed by the 2015 Water Plan, which further recognized that all water uses are interconnected and of equal value. However, the state recognizes that there are deep, unaddressed societal and institutional issues that pose significant barriers to advancing equity in water policy decisions. Addressing equity issues in water policy decisions will require bringing in a larger range of voices. Understanding that many of these challenges extend to other agencies, Tribes, regulatory considerations, and broader policy, CWCB’s initial step will require proactive engagement and inclusion of individuals and communities that have not traditionally been involved in water planning. Historically, Tribes have not had the resources, support, or ability to develop their water rights. Additional information on Tribal water rights can be found in Chapter 3.

**RECENT EXAMPLES OF EQUITY-RELATED ACTIVITIES**

**Equity Principles**
In the lead-up to the Water Plan update, a 21-member Water Equity Task Force was established to help develop guiding principles for the Colorado Water Plan. This adds to other state work, including CDPHE’s Climate Equity principles and the Environmental Justice Action Task Force Advisory Board. Together, multiple state agencies must consider how to better address EDI in all planning, including water planning.

**State Equity Office**
The Statewide Equity Office, created in 2022 by HB 22-1397, will provide best practices, resources, and guidance for state agencies in offering equitable services to the residents of Colorado as well as providing an accepting and diverse environment for State employees.

**Environmental Justice**
The CWCB works with CDPHE on EJ issues and has incorporated EJ into actions described in Chapter 6. According to the EPA, EJ is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

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“We don’t all start off at the same baseline. We don’t all have the same resources. But we should consider equity in thinking about how communities and producers across the state are supported to get to what they need to thrive.”

— Jessica Brody, CWCB

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30 Colorado State Demography Office
ENDANGERED AND THREATENED SPECIES RECOVERY PROGRAMS

Many of Colorado's water projects are likely to have a "federal nexus," meaning that they involve federal funding, federal permitting or licensing, use of federal lands, or a federal program. The existence of a federal nexus often triggers the need for ESA processes to evaluate whether a project is likely to jeopardize the continued existence of listed threatened or endangered species or result in the destruction or adverse modification of critical habitat. To mitigate these effects, Colorado participates in three recovery programs designed to protect and recover stream-dependent endangered and threatened species in various river basins while providing regulatory certainty and ESA compliance for water users. As a result, these programs encourage cooperative water management and habitat restoration.

Upper Colorado River Endangered Fish Recovery Program. Initiated in the 1980s, the UCEFRP Partners in this program are working toward the recovery of three endangered fish species—the bonytail, Colorado pikeminnow, and the razorback sucker—and one threatened fish species, the humpback chub. Partners include the states of Colorado, Wyoming, and Utah as well as multiple non-profits, water users, and federal agencies. In 2021, the humpback chub was reclassified from Endangered to Threatened—a major win for the Partners.

San Juan River Basin Recovery Implementation Program. The SJRIP was established in 1992 to recover the Colorado pikeminnow and the razorback sucker while allowing water development and management activities to continue in the San Juan River Basin. Because the basin is part of the Upper Colorado River Basin, the UCEFRP and the SJRIP operate in parallel. SJRIP partners include the states of Colorado and New Mexico; the Tribal governments of Navajo Nation, Jicarilla Apache, SUIT, and UMUT; multiple federal and non-profit agencies; and other water users.

Platte River Recovery Implementation Program. The PRRIP, established in 2007, was formed to support the recovery of four target species by enhancing, restoring, and protecting habitat in the Platte River in Nebraska while providing ESA compliance for water projects in Colorado, Nebraska, and Wyoming. The target species are the piping plover, least tern, whooping crane, and pallid sturgeon. Partners include the states of Colorado, Wyoming, and Nebraska, water users, and multiple federal and environmental agencies. In 2021, the USFWS announced that the interior least tern was fully recovered and officially removed from the endangered species list.

In addition to these interstate recovery programs, Colorado-driven fish and wildlife recovery programs are essential tools for protecting sensitive species before they are federally listed as threatened or endangered. Two examples include the Colorado River Cutthroat Trout Conservation Strategy and the Conservation and Management Plan for the Roundtail Chub, Bluehead Sucker, and Flannelmouth Sucker.


12 Utah Department of Natural Resources. 2006. Range-wide Conservation Agreement and Strategy for Roundtail Chub (Gila robusta), Bluehead Sucker (Catostomus discobolus), and Flannelmouth Sucker (Catostomus latipinnis).
NATURAL HAZARD PLANNING

Wildfire, drought, and flood events can be catastrophic and extremely costly, both in terms of dollars spent and in the loss of other systems whose costs cannot be quantified or replaced, such as ecosystem services. Colorado has seen a rise in severe and extreme events over the last two decades in part because of climate change. Without resilient planning, scientists expect many natural hazards to increase in frequency and intensity with a warming climate, which would result in increasing economic damages and ecosystem losses. Pre-hazard mitigation and planning are opportunities to reduce risk and lower costs associated with natural hazards.

TOOLS FOR NATURAL HAZARD PLANNING

FACE:Hazards

FACE:Hazards – The Future Avoided Cost Explorer (FACE) tool is an interactive dashboard that quantifies current and future risk from flood, drought, and wildfire across multiple sectors of Colorado’s economy, quantified as expected annual damage expressed in dollars. [FACE:Hazards | DNR CWCB]

Drought planning guidance – The CWCB assists water users and local planners across the state in resiliency planning and response to drought. This includes local drought plan. [Drought Assistance | DNR CWCB]

Wildfire Ready Watersheds

Wildfire Ready Watersheds – This CWCB program aims to provide a mitigation framework for communities to assess the susceptibility of their water resources and critical infrastructure to post-wildfire impacts. [CWCB Wildfire Ready Watersheds]

Colorado Fluvial Hazard Zone Mapping Program

Colorado Fluvial Hazard Zone Mapping Program – The CWCB developed a technical protocol to help communities identify, map, and plan for natural hazards associated with erosion, sediment deposition, and other dynamic river processes. [CWCB FHZ]

Although natural hazard events rarely unfold exactly as predicted, post-hazard risks can be mitigated ahead of time if communities have prepared by reducing some risks with the tools available to them.

Forest Health Planning Tools

The CWCB developed a list of models, tools, and funding sources concerning forest health.

[Link to the forest health planning tools document: Forest Health Study: 10 Takeaways to Inform the Colorado Water Plan]
LAND USE AND WATER PLANNING INTEGRATION

Historically, land use and water planning decisions have been made in a disconnected manner. Land planners (Planning Commissions, City Councils, and County Commissioners) make decisions about future developments that rely on water. Meanwhile, water planners often project supplies and demands in separate and disconnected analyses from land planners. Land use patterns have a strong influence on water demand. Subsequently, communities that implement a thoughtful land use and water planning nexus can more easily plan for and regulate future growth while providing adequate water supplies. As Colorado grows, integrated land use and water planning must be considered the minimum standard for moving forward.

Integrated land use and water planning can be a tool for protecting community water supplies, meeting future water demand, protecting water quality and riparian corridors, and/or establishing the appropriate location, pace, intensity, and sustainability of development. With that vision, efforts to develop resources to help support integrated planning were supported by CWCB, including the following:

RESOURCES TO HELP SUPPORT INTEGRATED PLANNING

Growing Water Smart Workshops – Colorado Growing Water Smart (CGWS) builds the capacity of local jurisdictions to plan and implement strategies for the integration of land use and water planning.

Best Practices for Implementing Water Conservation and Demand Management Through Land Use Planning Efforts – This CWCB guidebook assists water providers in integrating land use planning into their water efficiency plan.

Breaking Down Silos Webinar Series – The CWCB and DOLA created a series of webinars targeted at Colorado water providers and local government planners. Topics ranged from integrating water efficiency into comprehensive plans to zoning codes and planned unit developments.

The integration of land use and water planning is a crucial step when considering a secure water future for Colorado. Most communities are growing, and intentional and sustainable growth requires careful consideration.

Integration of Land and Water Planning Mantra:

“BUILD IT WATER SMART FROM THE START”

Link for more information on CWCB’s Land Use Program: Land Use | DNR CWCB

Link to: Integrating Water Efficiency into Land Use Planning in the Interior West: A Guidebook for Local Planners
DATA COLLECTION AND SHARING

The CWCB is proud that CDSS was named a Bronze Winner of the 2018 Horizon Interactive Award.

The CWCB is proud that CDSS was named a Bronze Winner of the 2018 Horizon Interactive Award.
WATER STORAGE

Water storage helps meet the year-round needs of agriculture, municipalities, recreation, and the environment. While snowpack is Colorado's greatest storage "facility," reservoirs hold water to be released during heightened demand or periods of drought. Nearly half of Colorado's storage capacity is located on the western slope in the Colorado River Basin and its tributaries.

Storage is comprised of both surface and underground storage. Surface water storage includes reservoirs and gravel pits and relies on water infrastructure, such as pumps, tunnels, and ditches, to convey water across the landscape. Underground storage includes alluvial and bedrock aquifers that offer potentially significant groundwater storage capability.

To support the water needs in Colorado, it is important to recognize that storage is an important tool to manage and share conserved water and address the challenges of a changing future climate. Most storage projects, however, were developed in the middle of the last century, and the construction of both new infrastructure and storage has remained relatively static over the last 30 years.

Future storage projects will include new storage facilities but should also work to increase capacity of existing reservoirs, address a diverse set of needs, involve partners, be increasingly innovative, or rely on technologies such as aquifer, storage, and recovery (ASR). Additionally, water managers will need to be more agile in responding to changing future conditions so that storage can be more rapidly added to Colorado's water portfolio while maintaining strong environmental health.

While storage is a critical element for managing Colorado's future water supplies, new storage projects can be contentious and may face permitting hurdles and uncertainties affecting supply.

Opportunities for storage include:

- Reallocating some flood storage to active storage
- Removing sediment stored or trapped in reservoirs
- Rehabilitating dams currently under storage restrictions
- Enlarging dams
- Constructing new dams and reservoirs
- Implementing ASR – unconfined ASR, confined ASR, and designated groundwater basins
- Using floodplain alluvial aquifer storage
- Maintaining existing storage by maintaining aging infrastructure
Conveyance infrastructure is critically important for meeting Colorado’s water needs. While storage projects are important for capturing available supply, conveyance infrastructure moves the water from reservoirs, streams, and aquifers to where the water is needed using pipes, pumps, diversion structures, headgates, and ditches. Conveyance is critical for agricultural purposes in moving water from streams and irrigation wells to farm fields. In a municipal setting, conveyance infrastructure moves water from storage reservoirs to water treatment plants, from treatment plants to homes, and from homes to wastewater treatment facilities.

Often, the most expensive components of a water development project are the conveyance facilities. Water may need to be transported over many miles from its source to end use, which results in high material costs, extensive land or easement purchases, and potentially lengthy and expensive permitting processes. While conveyance infrastructure is often buried and out of sight, it represents a significant investment and an important component of how we get water.

Much of Colorado’s agricultural conveyance infrastructure was constructed decades ago, and efforts are underway across the state to upgrade and maintain the infrastructure. The BIPs included many examples of projects with conveyance infrastructure upgrades. The scale of the aging infrastructure issue is large, and a future challenge will be funding all the aging agricultural infrastructure needs across Colorado. Incorporating additional benefits into structure improvements, such as fish and/or boat passage and recreational access, can enhance resiliency and potentially bring additional sources of funding. Collaboration with environmental and recreational interests before and after a project can help ensure that improvement projects meet their intended purposes.

Conveyance infrastructure will continue to be important in managing water supplies in the face of changing hydrology. Collaborative approaches to developing conveyance infrastructure will be important in the future to minimize cost and to maximize resilience in the face of uncertainty.

Examples

La Plata West Water Authority Raw Water Pipeline.
> WO
La Plata West Water Authority was one of the first to use water from the Animas-La Plata Project via a newly constructed raw water delivery system to Lake Durango’s treatment plant, completed in 2019. Future expansions of the treated water system continue, with the initial phase of 32 miles of pipeline completed at the end of January 2020.

The Southern Delivery System.
> WO
The 50-mile Southern Delivery System water pipeline began delivering Arkansas River water from Pueblo Reservoir to Colorado Springs and Fountain in 2016.

Southern Water Supply Pipeline (Phase II).
> WO
Started in the 1990s and completed in 2020, Northern Water constructed a 20-mile pipeline from Carter Lake south to Boulder Reservoir Water Treatment Plant. This project provides raw water for several communities.
WATER EFFICIENCY AND CONSERVATION PROGRAMS

Municipal Conservation and Efficiency

Municipalities, special water districts, and other water providers have progressed in water conservation over the last 20 years. Water efficiency savings can reduce water demands and provide a buffer against drought. Municipal water conservation can help providers reduce the amount of costly system expansions needed in the future. In addition to water supply benefits, municipal water conservation can improve water quality, improve aquatic habitat, and ease the burden of political and regulatory requirements. The importance of municipal conservation and efficiency continues to grow as Colorado's population increases and climate change increases uncertainty in water supplies.

In Colorado, water providers that deliver more than 2,000 acre-feet of water annually are required to have a CWCB-approved Municipal Water Efficiency Plan. While many water providers have adopted best practices such as water loss management, water conservation is tightly linked to human behavior. An effective water conservation program often has a strong education component, incentives to drive innovation, right pricing to facilitate efficient water use, and regulatory components to create water efficient development as well as to reduce water waste.

The CWCB recognizes municipal water conservation and efficiency will be an important tool for reducing water use. Water conservation programs are relatively less expensive ways to reduce water demand through water efficiency and will be a critical implementation strategy to optimize water supply in Colorado.

Agricultural Conservation and Efficiency

Water conservation and efficiency in agriculture often considers the balance between the environment and becoming more efficient and resilient by reducing non-beneficial water use without affecting agricultural productivity. Discussions about agricultural water use and efficiency can be complicated because of incomplete understandings of agricultural water systems. In many parts of the state, a large part of the agricultural and environmental water supplies are provided by “return flow,” and these flows can be affected by water efficiency strategies. For more information on return flow, see Chapter 3.

Benefits of agricultural conservation and efficiency can include increased crop production, reduced vulnerability to drought, enhanced flows for the environment and recreation, and improved water quality. In many cases, better irrigation efficiency results in water application that is more in sync with plant demands (both in timing and amount), which results in fully utilizing and consuming the available supply.

Agricultural conservation and efficiency will be an important tool to stretch water supplies to help meet future needs and maximize the economic benefit of agricultural lands for irrigators and rural communities.

CWCB has seen communities reduce water use by:
- Reducing non-functional turf—establishing turf buyback programs and enacting comprehensive landscape ordinances that limit new turf to functional spaces.
- Limiting water loss—engaging in best practice-based water loss control and management through robust water loss audits and comprehensive analysis.
- Establishing water budget rate structures and conservation oriented tap fees—encouraging sustainable water management through right sizing the connection to the water system while charging the appropriate amount based on what is needed.

Link for more information on CWCB's Urban Water Efficiency Programs: Urban Water Efficiency | DNR CWCB
WATER REUSE

Water reuse occurs when return flows from one use are treated and reused for another beneficial purpose such as agriculture and landscape irrigation, drinking water, groundwater replenishment, industrial processes, or environmental restoration, among others. For water users with legally reusable water supplies, water reuse can provide alternatives to existing water supplies and be used to enhance water security, sustainability, and resilience within Colorado water law.

In Colorado, most reuse systems focus on non-potable uses through Colorado’s Regulation 84, which sets water quality standards for reclaimed water for non-potable uses such as landscape irrigation, crop irrigation, and commercial and industrial processes. The use of “graywater,” regulated under Regulation 86, is another means by which water may be reused for non-potable uses. Graywater is wastewater reused on-site for specific approved uses after being collected within a building from bathroom and laundry room sinks, bathtubs, showers, and laundry machines. However, there continues to be significant challenges to implementing graywater technology, including difficulty of retrofitting existing buildings, general lack of interest on the part of local governments to enact local graywater ordinances, lack of interest from developers, and concerns that property owners could be resistant to operating and maintaining a graywater system within their residences.

There is growing interest in water reuse for augmenting potable water supplies in Colorado. Surface water quality standards and Safe Drinking Water Act requirements for potable treatment control this reuse (which also drives discharge permit limits from water reclamation facilities). Increasingly common are intentional, indirect potable reuse (IPR) projects, which involve adding treated wastewater to an environmental buffer, such as a lake or stream, before the water is diverted and treated at a drinking water facility. DPR is when drinking water is produced through a series of treatment processes using a source containing treated wastewater that has not passed through an environmental buffer. While there are no active DPR projects in Colorado, WQCC recently modified Colorado’s Regulation 11 Primary Drinking Water Regulations, to allow for DPR.

Widespread development of potable reuse and allowance of different uses for reuse water will be an important facet of meeting future water needs, but Colorado needs to continue making progress in overcoming these challenges, in which public education and outreach will play a key role.

REUSE HIGHLIGHTS

Graywater Pilot Study:
At present, CWCB is funding a 40-home pilot project with built-in graywater systems and advanced household leak detection. All units should be installed and operational by the end of 2022, and subsequent study and analysis will demonstrate the amount of demand reduction per household.

PureWater Colorado Mobile Demonstration Project:
Funded by a grant from CWCB, Colorado Springs Utilities and its partners designed and constructed an advanced water purification system inside of a mobile trailer using treated wastewater from the JD Phillips Resource Recovery Facility to produce potable water. The DPR trailer was used by Colorado Springs Utilities in 2021 and 2022 for public education and outreach, operator training, and treatment process refinement. Looking forward, the trailer is owned by the Colorado School of Mines and can be used by utilities across the state for these and other purposes, to advance the science and community engagement for potable reuse.

DPR Rule:
In October 2022, WQCC adopted changes to Colorado Primary Drinking Water Regulations (Regulation 11) to govern DPR after a rigorous stakeholder process led by WQCD.
COLLABORATIVE WATER SHARING AGREEMENTS

COLLABORATIVE WATER SHARING AGREEMENTS (CWSAs), formerly known as ATMs, are innovative and flexible water use agreements between two or more users, typically involving agricultural, municipal, or environmental users. CWSAs provide a temporary, voluntary, and compensated alternative approach to the “buy and dry” method that occurs when a water provider purchases senior agricultural water rights, formally changes the water’s designated use through water court, and from farmland. While the focus and agriculture, they can

The CWCB and other stakeholders have taken important steps to encourage CWSA development, building on direction from the Water Plan. Despite ongoing support at the state level for CWSA development, the adoption of CWSAs remains hampered by several long-standing barriers, such as the lack of infrastructure to deliver water from CWSAs to a new use, lack of accessible information on potential impacts or benefits, the cost of development and implementation, and ability to address the diverse needs of all parties to a deal. The status of CWSAs, a list of barriers and solutions to those barriers, suggested criteria for defining CWSAs, and other recommendations are being considered by CWCB and are described in a report entitled “Alternative Transfer Methods in Colorado, Status Update, Framework for Continued Support, and Recommendations for CWCB Action,” published in July 2020.

CWSAs are an essential tool to meeting future water needs. They are flexible, adaptable, and innovative alternatives that allow all water sectors to benefit and meet future demands.

New Terminology: CWSA

Despite being in use since the early 2000s, water users have expressed interest in moving away from the term “alternative transfer method.” Many in the Colorado water community view ATMs narrowly and as being focused almost entirely on the temporary dry-up of agriculture to meet Front Range municipal water needs. A survey conducted by WaterNow Alliance suggested that a term describing a more comprehensive suite of water sharing/leasing activities would be acceptable.

The CWCB will, in the future, refer to these types of agreements as “collaborative water sharing agreements” to better reflect the broad set of water-sharing tools and approaches that are currently used and may be used in the future.


Give ag better choices than to sell out to big conglomerates.

— Curran Trick, CWCB
Stream restoration resources are diverse and reflect the wide-ranging approaches used and expertise required. The U.S. Departments of Agriculture and Interior developed a guide to the various techniques and schools of thought on stream restoration to help users educate themselves for specific projects.13


Watershed Protection and Restoration | DNR CWCB

Nature-Based Solutions

Nature-based solutions are actions to protect, sustainably manage, or restore natural or modified ecosystems as solutions to societal challenges, like mitigating water insecurity and climate change risk.14 Examples of nature-based solutions include protection or conservation of natural areas, reforestation, restoration of wetlands or other habitats, or sustainable management of farms or forests. These actions can increase resilience to threats like flooding and wildfire and can slow climate change by capturing and storing carbon dioxide. Nature-based solutions can be considered in many of the tools suggested in the Water Plan including watershed management, natural hazard planning, and stream/watershed restoration.

Nature-based solution example: Protecting and supporting existing beaver populations and their habitat where appropriate is a desirable management tool in many forested areas to protect flow regimes, balance healthy patterns of sediment erosion and deposition, and improve aquatic habitat. Utah State University’s Beaver Restoration Assessment Tool (BRAT) is a planning tool to help resource managers assess the potential for use of beavers as a stream conservation and restoration agent over watersheds.

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Chapter 5: Challenges and Tools

FLOW ENHANCEMENT AND MAINTENANCE

Climate change, increased stream alterations, and depletions to meet consumptive water needs will continue to impact the flow regime of Colorado streams. In the face of these challenges, it will become increasingly important to ensure that there are sufficient streamflows to meet environmental and recreational needs. There are a suite of flow enhancement and maintenance tools that can be used to alter or maintain the amount and timing of flow in a stream to protect or improve the natural environment and/or recreational opportunities. Some key examples include:

• Recreational in-channel diversion water rights are water rights for recreational boating on natural streams. Only local governmental entities can apply for RICDs, which are required to have control structures like constructed whitewater park features. Flows associated with RICDs are limited to the minimum streamflow necessary for a reasonable recreational boating experience in and on the water. The CWCB reviews all applications for RICDs on behalf of the State. The RICD legislation was established in 2001 and amended in 2006.

• Instream Flows and Natural Lake Level Water Rights
  ISF and NLL water rights protect streamflow in specific reaches of streams and water levels in natural lakes. The CWCB appropriates these non-consumptive water rights on behalf of the people of Colorado to preserve the natural environment. Any person or entity can make a recommendation to CWCB to appropriate a new ISF or NLL water right. The CWCB prioritizes ISF recommendations that focus on streams important for threatened, endangered, and imperiled native species or important recreational sport fisheries. Since the Colorado General Assembly authorized the program in 1973, the CWCB has secured ISF water rights on over 1,700 stream segments covering more than 9,800 miles of stream, and NLL water rights on 482 natural lakes.

  Willing water right owners can also voluntarily donate, lease, or sell their water rights to CWCB for ISF use. When a water right is acquired for ISF use, it retains its priority date, providing CWCB with a more senior water right to preserve or improve streamflows. There are several different acquisition tools that range from short-term and temporary agreements to long-term and permanent arrangements:

  • Expedited Temporary ISF Lease - allows for ISF use for up to one year for a maximum of 120 days in a calendar year.
  • Renewable Temporary ISF Lease - allows for ISF use for up to 5 years in a 10-year period, for not more than 3 consecutive years for up to 120 days in a calendar year.
  • Long-Term ISF Lease - allows lease or donation of water rights for ISF use over an extended period of time.
  • Permanent ISF Donation or Purchase - permanently changes the water right to allow ISF use.
  • Protected Mitigation Releases - allows owners of new or enlarged storage rights to contract with the CWCB to release and protect water necessary to minimize or mitigate impacts to fish and wildlife resources.
  • Streamflow Augmentation Plan - allows previously quantified and changed water rights to be used to augment streamflows.

The CWCB has completed more than 35 voluntary water acquisition transactions.

Alternative Wild and Scenic Management Plans are stakeholder-driven processes that provide for the permanent protection of “outstanding remarkable values” but provide more flexibility for water users than the Wild and Scenic federal designation. While Alternative Wild and Scenic Management Plans are not a flow enhancement and maintenance tool by themselves, they can use ISFs to achieve their goals.

Links for more information on:
• CWCB’s Recreational In-channel Diversion Program: Recreation | DNR CWCB
• CWCB’s Instream Flow Program: Instream Flow Program | DNR CWCB
• CWCB’s Wild and Scenic Rivers Fund: Wild and Scenic Rivers Fund | DNR CWCB

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The tools described in Chapter 5 include both established and innovative strategies that Coloradans implement to meet water challenges. They are the tools that can be deployed in the actions described in Chapter 6 that seek to achieve the Water Plan’s vision for meeting future water needs.

**Non-diversion agreements** allow water users to consume less water without injuring their water rights. The unused water that results from these agreements remains in the stream.

Cooperative reservoir release programs provide stakeholders with a framework for collaborative integration of dam operations and downstream resource protection and management. Cooperative reservoir releases can help boost hydropower generation, help meet existing instream flow needs, and provide additional flows for sensitive aquatic species. Water managers and reservoir operators can obtain input from environmental and recreation stakeholders regarding the timing and ramping-up and ramping-down rates of reservoir releases so that releases enhance or at least minimize adverse impact to rivers, aquatic species, and recreational flows. Through adaptive management, regular communication, and by maintaining a historic database of releases, they can refine practices and continually improve the impact that reservoir releases have on aquatic health.

Collaborative Water Sharing Agreements, described earlier in this document, can also serve as an important flow enhancement and maintenance tool.

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**OUR OUTDOOR RESOURCES ARE THE FOUNDATION OF OUR STRONG ECONOMY AND A KEY CONTRIBUTOR TO THE COLORADO WAY OF LIFE.**

— HEATHER DISNEY DUGAN
Acting Director, Colorado Parks and Wildlife

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**INNOVATIVE STRATEGIES TO MEET WATER CHALLENGES**

15 Mile Reach near Grand Junction on the Colorado River Provides Critical Habitat for Four Rare Native Fishes — the bonytail chub, Colorado pikeminnow, humpback chub, and razorback sucker — that are listed as either federally threatened or endangered. In addition to long-term supplies secured to augment streamflows for listed fish, CWCB has partnered with multiple entities including the Colorado River Water Conservation District, Colorado Water Trust, Garfield County, and Ute Water Conservancy District to further enhance flows in the 15-mile reach using leased water from Ruedi Reservoir. These multi-benefit releases generate hydropower, help meet the existing instream flow rates, and provide additional flows to achieve the U.S. Fish and Wildlife Service flow targets as part of the Upper Colorado River Recovery Program.
CHAPTER 6

VISION and ACTIONS for ADDRESSING COLORADO’S RISKS
The path forward described in the Water Plan includes:

COLORADO VISION

Colorado’s roadmap for how it will address its key challenges is captured across four Action Areas, each with a vision that supports the Water Plan’s values and can be achieved through action.

ACTIONS

The Water Plan has about 50 example partner actions for stakeholders and 50 agency actions for CWCB and collaborating agencies that will advance the Water Plan and support the Colorado Vision.

Chapter 1 provides more background on the visions and actions.
Chapter 6: Vision and Actions for Addressing Colorado's Risks

The most important aspect of the Water Plan is the vision it provides for how Coloradans will meet water challenges and the actions that stakeholders and CWCB along with other state agencies can take in the near term to help the vision become a reality.

The State cannot achieve this vision alone—it takes all of us.

Chapters 1 through 5 of the Water Plan laid the foundation for the visions and actions described in Chapter 6. They provided information on: a) the structure of the Water Plan; b) Colorado's water resources and water-related risks; c) local challenges and costs of projects needed to meet needs throughout the state; d) and a general description of the tools or solutions that Colorado has at its disposal to meet challenges shared by all sectors of water use. Chapter 6 describes the path forward.

The Water Plan is organized around four action areas (Vibrant Communities, Robust Agriculture, Thriving Watersheds, and Resilient Planning). The areas help functionally organize topics, but these areas are interconnected and interdependent. For each action area, Chapter 6 describes:

**COLORADO VISION**

- The vision for how Colorado can achieve greater resilience in each of the four action areas by 2050.

**PARTNER ACTIONS**

- Partner actions identify examples of opportunities for individuals and communities to help achieve the vision. These are actions that the CWCB cannot do alone and will require effective engagement at different scales. Examples of project-level partner actions are organized by topics that align with CWCB's Colorado Water Plan grant project categories (as shown in the table below):

<table>
<thead>
<tr>
<th>WATER PLAN FUNDING CATEGORY</th>
<th>PARTNER ACTION CATEGORY</th>
</tr>
</thead>
</table>
| Water Storage and Supply Projects | Thoughtful Storage  
Storing water and creating reliable supplies for farms and communities and multi-purpose benefits for the environment and recreation |
| Water Sharing Agreements | Meeting Future Water Need  
Providing supply, improving water management, and lowering risk for all sectors |
| Conservation and Land Use Projects | Wise Water Use  
Using water more efficiently and creating multi-benefit projects |
|                             | Healthy Lands  
Creating landscapes that will be healthy and productive in a warmer and drier future |
| Engagement and Innovation Activities | Effective Engagement  
Fostering information sharing, education, and innovation at the state and local level |
| Agricultural Projects | Robust Agriculture  
Supporting all aspects of Robust Agriculture partner actions |
| Watershed Health and Recreation Projects | Thriving Watersheds  
Supporting all aspects of Thriving Watersheds actions |

**AGENCY ACTIONS**

- CWCB and other state agencies will complete during the current Water Plan cycle to help move Colorado toward the vision. Beyond the four action areas, the Water Plan includes an additional 10 actions CWCB will complete that are more general or administrative and do not correspond to a specific action area. In total, 50 agency actions are identified.

Link for more information on CWCB's grants and loan programs:
Funding | DNR CWCB
Robust agriculture supports a sustainable agricultural economy and culture where farms and ranches are profitable and a high quality of life for farming communities is maintained.

**VISION:**
Agriculture not only provides food and fiber, but it is also important to Colorado’s culture, heritage, and economy, needed to sustain irrigated agriculture, including strategies needed to sustain irrigated agriculture, including strategies needed to sustain irrigated agriculture, including strategies needed to sustain irrigated agriculture, including strategies needed to sustain irrigated agriculture, including strategies needed to sustain irrigated agriculture, including strategies needed to sustain irrigated agriculture, including strategies.

**PARTNER ACTIONS:**
Thoughtful Storage: 
Meeting Future Water Need: 
Wise Water Use: 
Healthy Lands: 
Engaged Partners: 
Integration with Other Water Sectors: 

**AGENCY ACTIONS:** 1.1 to 1.10

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Vibrant communities are economic and cultural centers, spaces for innovation, where Coloradans live, play, and work.

**VISION:**
Holistic water management is essential for creating vibrant communities that balance water supply and demand needs to create a sustainable urban landscape. Colorado communities need resilient water supplies, water-conscious and attractive urban landscapes, planning that integrates land use and water solutions, and residents who understand the importance of water to their lives and economy. An integrated One Water ethic is necessary to create the transformative change needed to meet the moment and the future.

**PARTNER ACTIONS:**
Thoughtful Storage: 
Meeting Future Water Need: 
Wise Water Use: 
Healthy Lands: 
Engaged Partners: 
Integration with Other Water Sectors: 

**AGENCY ACTIONS:** 2.1 to 2.10
Thriving Watersheds

Resilient Planning

Vision: Colorado's watersheds hold the future of our water supply and provide reliable water supplies while mitigating natural hazard risk. We need to work together to build solutions that enhance the health of our watersheds and resilience.

Partner Actions:
- Thoughtful Storage: Storage can help communities develop reliable water supplies while mitigating natural hazard risk.
- Meeting Future Water Need: One Water approaches can meet needs, enhance water quality, and build resiliency.
- Wise Water Use: Raising awareness and improving accessibility to water efficiency programs is a cornerstone of solving water challenges.
- Healthy Lands: Adaptive strategies are needed for climate change resilience.
- Engaged Partners: Creative solutions supported by thoughtful and efficient government are needed and can promote sustainability and resiliency.

Integration with Other Water Sectors: Efforts to improve stream health or function often benefit other water sectors.

Agency Actions: 3.1 to 3.10

Integration with Other Water Sectors: Coloradans need to work alongside each other to build solutions together and resilience.

Agency Actions: 4.1 to 4.10
CREATE TRANSFORMATIVE CHANGE

Holistic water management is essential for creating vibrant communities that balance water supply and demand needs to create a sustainable urban landscape. Colorado communities need resilient water supplies, water-conscious and attractive urban landscapes, planning that integrates land use and water solutions, and residents who understand the importance of water to their lives and economy. An integrated One Water ethic is necessary to create the transformative change needed to meet the moment and the future.

Vibrant communities are economic engines, culture and recreation centers, and spaces for innovation. Our communities come in different sizes, from large metropolitan areas that are highly urbanized to small rural towns that are closely connected to surrounding agricultural or forested areas. From small towns to large cities, we need to prepare for the future with renewed water efficiency practices, implementing conservation programs, and controlling water loss. We also need to provide climate-appropriate greenspaces and access to healthy waterways in urban settings to enhance the quality of life for our residents. Communities need to invest in cutting-edge strategies that address current challenges and build future resilience that will help us adapt to a warmer climate and reduce per capita water use.

Colorado’s legal and regulatory framework has flexibility to implement cutting-edge strategies, but it can also be refined through established legislative and regulatory processes to better accommodate our needs.

What is a One Water ethic?

One Water is a movement, a shift in thinking, and the future of how we manage our water resources with practical and bold ideas coming together in a collaborative way. While water knows no boundaries, how we manage and regulate water is highly fragmented—requiring interdisciplinary solutions that create more equitable, sustainable, and resilient communities. The Water Research Foundation defines One Water as “an integrated planning and implementation approach to managing finite water resources for long-term resilience and reliability, meeting both community and ecosystem needs.”

One Water encourages collaboration among all agencies with roles related to water resources. Its overall goal is to create a common framework for reliably managing water systems to meet public and environmental needs while reducing costs, improving resilience, and enhancing community livability. Since most One Water projects aim to address water supply and demand challenges in a localized setting, they include a variety of site-specific components, such as water recycling, graywater reuse, and rainwater harvesting, which may be incorporated into land use planning.

For example, the Denver One Water Plan represents the guiding principles for a shared water vision in Denver. It provides sustainable solutions that include the entire water cycle through deliberate policies, consistent approaches, and streamlined inter- and intra-organizational partnerships. While this is a positive direction, our towns, cities, and counties need to increasingly view comprehensive and long-term planning through a One Water lens. Water should be included in every city and county’s comprehensive plan in ways that embrace the One Water ethic and support inclusion in water and land use planning at the local level.
## Support for Action

<table>
<thead>
<tr>
<th>SUPPORT FOR ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PARTNER ACTIONS</strong></td>
</tr>
</tbody>
</table>

### Thoughtful Storage
- **Strategically located storage facilities that meet multiple needs:** Small storage.
  - **Location:** Z
  - **Facilities:** V
  - **Storage:** W
- **Storage to meet growth and future uncertainty:** Large storage.
  - **Location:** Z
  - **Facilities:** V
  - **Storage:** W

### Meeting Future Water Needs
- **Innovative surface and groundwater storage:** Expanded to store more water with less environmental impact.
  - **Location:** Z
  - **Facilities:** V
  - **Storage:** W

### Supplies that provide reliable and safe drinking water:
- **Location:** Z
- **Facilities:** V
- **Storage:** W

---

**The state legislature and the CWCB support these efforts through the Colorado Water Plan Grant Program. The areas of partner actions generally align with the CWCB's Colorado Water Plan Grant Program that has legislatively-established funding areas for agriculture, conservation and land use, engagement and innovation, environment and recreation, and water storage and supply. In many cases, CWCB loans or other grant funding sources provided by federal and state agencies or other groups noted in Chapter 3 (also see Chapter 3 Framework for State of Colorado Support for Water Projects) are also available and can support work within and beyond the scope of Water Plan grants. In some cases, funds from different sources can be used to fulfill matching requirements.**

**Examples of these “partner actions” are highlighted below, followed by details on supporting agency actions.**

### Thoughtful Storage
- **Small storage facilities are useful for providing water when and where it is needed. They can be less impactful on the environment and can meet multiple, local needs.**
- **Storage to meet growth and future uncertainty:** Large storage.
  - **Location:** Z
  - **Facilities:** V
  - **Storage:** W

### Meeting Future Water Needs
- **Supplies that provide reliable and safe drinking water:**
  - **Location:** Z
  - **Facilities:** V
  - **Storage:** W
Wise Water Use

**Implementing water-saving measures:** Water

- **Optimize investments in infrastructure and increase efficiency and conservation:** Municipal water providers should incorporate water conservation strategies into their planning, including advanced metering infrastructure (AMI) or other technologies to accurately bill customers and reduce water loss. Thoughtful system monitoring and timely repairs can minimize water loss through consistent auditing.

- **Proper and accurate monitoring of water use and reduction in water loss:** Municipalities reduce demand and delay the need for, or downsize additional infrastructure.

- **Rate structures (water budgets, water conservation focused tiered rate structures):** By implementing rate structures that encourage water efficiency, municipalities ensure water is used fully. Reusing water when legally allowable is key. Customer equity issues should be considered when designing rate structures.

- **Investments in One Water and reuse:** Investments in One Water and reuse ensure water is used fully. Reusing water when legally allowable is key. Customer equity issues should be considered when designing rate structures.

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- **Planning for and creating low-water-use landscapes:** Planning for and creating low-water-use landscapes is essential. Investments in One Water and reuse: Water in Place

- **Healthy Lands**

- **Urban agriculture:** Urban agriculture helps improve local foods can be produced in urban areas. Projects that...
Chapter 6: Vision and Actions for Addressing Colorado’s Risks

INTEGRATION ACROSS ACTION AREAS

The partner actions noted above and the agency actions that follow often relate to one or more of the other action areas of the Water Plan. Water uses in Colorado’s communities connect to other communities and to watersheds and agriculture. Collaboration is needed across action areas to identify these interconnections when considering strategies for meeting water needs. Here are some of the ways Vibrant Communities connects to the other action areas:

ROBUST AGRICULTURE

Actions that preserve or promote agriculture, both within and adjacent to municipal boundaries, help maintain open space, create educational opportunities for both urban and rural residents, and provide for local food production. More efficient water use and additional storage in communities can delay or prevent the need to acquire and transfer agricultural water supplies. Collaborative water sharing agreements between farms and cities can help enhance municipal resilience.

THRIVING WATERSHEDS

Many of Colorado’s communities are located along streams and rivers. Preserving, enhancing, and restoring streams in urban corridors and protecting their flows can provide environmental and recreational benefits as well as provide attractive landscapes, shade, and water quality benefits for urban residents. Efficient use of water supplies in communities can benefit the environment if more water is left in streams or if municipal water operations can be flexible and enhance streamflows.

RESILIENT PLANNING

Improving urban stream corridors can reduce flood risk, improve habitat, and create green spaces, which will help urban residents adapt to a potentially warmer future climate with higher flood risk. Education and outreach that considers varied ethnicities will be important to building resilience and gaining support for actions.

Existing agricultural lands are sometimes enveloped by cities. In other cases, underused urban lands can be used for agricultural purposes. Urban agriculture can preserve open space, draw closer connections between urban residents and agriculture, and potentially provide water conservation and stormwater benefits in some settings. Land use codes could be updated to foster urban agriculture.

Partner Actions Rely on Effective Engagement and Education at Different Levels

Partner engagement is critical to the success of the Water Plan. Partners do not just include the typical stakeholders that engage in water issues – partners include all Coloradans. Partner engagement needs to occur at different scales—from the federal and state levels down to local government and individual residents, as described below:

• Government: State, county, and city governmental entities as well as water districts and water conservancy/conservation districts should leverage resources and coordinate public education and awareness campaigns that focus on topics like water efficiency and reuse. Local projects that explore and research emerging strategies, pilot programs, and new ways of doing more with less water should be supported. Local building or land use codes and ordinances should promote indoor and outdoor water use efficiency.

• NGOs, business: NGOs, academia, and others engage residents, advance research on water issues, and need funding. Public-private partnerships should be supported that focus on research and other joint efforts. The business community should be engaged to promote innovation and identify new technologies for conserving and tracking water use.

• Residents: All Coloradans should be conscious of their “water footprint” and adopt a water-saving ethic. Every resident should have the opportunity to engage in water issues, know their local water sources, and understand how to conserve. Engagement helps promote inclusion and larger support for water. Inclusive outreach and education tailored to meet regional needs and diverse populations and age groups will need to be conducted to achieve this objective.
AGENCY ACTIONS

The CWCB and partnering agencies will take the following actions to support and advance Colorado’s vision for Vibrant Communities. Each action identifies a lead agency, and in most cases, one or more collaborating agencies. The lead agency is directly responsible for completing an action. Collaborating agencies will partner to successfully complete the action by providing guidance or actively staying informed. Both lead and collaborating agencies envision using existing staff and available resources. Collaborating agencies may provide more leadership or support if additional resources become available. In addition, other agencies may be consulted as needed or if resources become available.

VIBRANT COMMUNITIES

Lead Agency: CWCB

Collaborating Agencies: DOLA; CDPHE

Related Action Area: Not applicable (N/A)

1.1 Define, benchmark and institutionalize water-saving communities

Lead Agency: CWCB

Collaborating Agencies: DOLA; CDPHE

The CWCB will fund and participate in the development of a framework that includes target metrics and definitions for water-saving communities. Doing so will set a benchmark for resilience that can drive municipal water operations, planning, and management. Developing a framework that provides a range of targets for water-saving communities and identifying solutions that can help future-proof communities will build additional resilience into municipal operations, planning, and management. The framework will include expanding links between land use planning and water planning and include prioritizing inclusion of water planning in comprehensive plans. It will also include building conservation strategies and tools into traditional planning disciplines and measuring ongoing progress toward decreased indoor and outdoor water use through programmatic efforts.

THE COLORADO WATER AND LAND USE PLANNING ALLIANCE

This group has convened stakeholders and educated policy makers since 2017.

From state agencies, local governments, advocacy organizations, research organizations, and other interested parties who come together collaboratively to develop resources, provide technical assistance, and track progress on water and land use integration across Colorado. The Alliance has effectively convened stakeholders and educated policy makers to advance objectives that carry forward from the 2015 Water Plan to ensure Coloradans would live in communities that have incorporated water-saving actions into land use planning. Going forward, the Alliance will continue to be a forum for important policy discussions about water and land use planning integration, as well as a testing ground for best practices learned on the ground that advance holistic planning with a One Water focus.

TOOLS used for this action

- Water efficiency and conservation programs
- Land use and water planning integration
- Policy and regulatory changes
- Public outreach and education
1.2 Enhance municipal water efficiency reporting and data integration

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**Lead Agency:** CWCB

**Collaborating Agencies:** K >

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**TOOLS** used for this action

- Land use and water planning integration
- Water efficiency and conservation programs
- Data collection and sharing

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**WATER USE REPORTING**

- Water utilities that annually supply 2,000 acre-feet of water to customers are required to report water usage data pursuant to House Bill 10-1051 (often referenced as “1051 reporting”). The data collected via 1051 reporting is important for understanding current water usage, the impacts of water conservation and efficiency, and making more accurate forecasts of future water use.
1.3 Drive enhanced water loss tracking to help address future water needs

**Lead Agency:** CWCB

**Collaborating Agencies:** K > VW,

Water loss continues to account for a significant portion of municipal water use in the state. As infrastructure ages, real losses (leaks) and apparent losses (meter inaccuracies, data handling errors) increase, and valuable water resources and revenue are lost. Minimizing water loss through comprehensive water loss control and management is critical for maintaining the fiscal, operational, and water resources fitness of water utilities statewide. Through past efforts of the Colorado Water Loss Initiative, CWCB has helped advance base level and more advanced water loss analyses across a wide variety of water utilities with varying levels of expertise.

Reinforcing current progress and increasing adoption of advanced water loss best practices will require CWCB to develop a third phase of the Colorado Water Loss Initiative. The goal would be to not only train more utilities on how to track and manage water loss but to explore creating capacity for third-party validators to provide independent analysis and verification of water loss. Impartial third-party validators can help support utilities in finding deeper savings in areas they may otherwise underestimate or overlook. Advancing this work should also consider ways that utilities, technology, and outreach can be leveraged to help utilities not only reduce water loss but help end users more actively implement water loss control practices and directly influence utility investments to reduce system losses.

**TOOLS used for this action**

- Water efficiency and conservation programs
- Data collection and sharing
- Land use and water planning integration

**COLORADO WATER LOSS INITIATIVE**

The goal of the Colorado Water Loss Initiative is for participating water utilities to learn how to apply the methodology to their water system and to achieve a complete and transparent water loss audit (as measured by Level 1 validated scores).

At present, CWCB is implementing Phase II of the CWLI which builds on the very successful Phase I where 53 water providers were trained in basic water loss methodology. The CWLI is using the industry standard M36 AWWA water loss control and management methodology.

In Phase II, CWCB is carrying out a comprehensive program of basic and advanced training in water loss management, ranked and prioritized technical review, and technical assistance for approximately 70 water providers across the state. This 24 to 30 month program includes multiple “touch points” for establishing principles and practice as well as reinforced understanding, culminating in direct technical assistance based on the water provider’s needs. This phase goes beyond audits and assists the water providers in targeting interventions. Water loss was identified in the Technical Update as a significant factor in the municipal and industrial gap.
1.4 Coordinate funding opportunities for conservation, safety, and aging infrastructure

**Lead Agency:** CWCB

**Collaborating Agencies:** W.V.K \(\rightarrow\) VtZVWt

Aging infrastructure is an ongoing challenge, especially for smaller communities where system water loss, treatment, and water metering are major issues. These communities are often extremely susceptible to system water issues that are exacerbated by climate extremes like flood and drought. Coordination among the state agencies that provide water quality and quantity funding opportunities ensures funds are targeted to priority projects and leveraged more effectively. The CWCB, CDPHE, and DOLA will work to increasingly coordinate outreach efforts with each other. These efforts will work to promote grant and loan opportunities, introduce shared training opportunities, and support shared messaging that can be used across agencies based on needs that have been highlighted by the basin roundtables. This aims to strengthen local understanding that water loss and water leaks can contribute to water quality issues and that attaining effluent temperature standards can also support stream restoration efforts. In addition, cross-agency coordination with DWR can also help evaluate and identify aging dam infrastructure. Once identified, this could be used to create an overlay that helps focus where to encourage communities to use grants and targeted spending to address dam safety issues.

**Tools** used for this action:

- **Funding**
- **Public outreach and education**
- **Conveyance infrastructure**
- **Collaboration groups**
- **Equity**

**Related Action Area:**
- Robust Agriculture
- Resilient Planning

Headgate on the Conejos River, Photo Credit: Russ Sands
1.5 Strategically expand water reuse and develop a water reuse progress report

**Lead Agency:** CWCB  
**Collaborating Agencies:** CDPHE

The CWCB, CDPHE, groups like WateReuse Colorado, and many other stakeholders have worked intensively over the past seven years to develop the technical background necessary to advance DPR and to increase the uses allowed for under Regulation 84 Reclaimed Water (i.e., non-potable reuse). Where possible, CDPHE and CWCB will continue to coordinate shared approaches to managing workloads and work together on future stakeholder discussions. In addition to the implementation needs of Regulation 84 and Regulation 86 (Graywater), CWCB supported CDPHE in the leadup to the 2022 DPR rulemaking and will continue to support CDPHE as they begin to administer the new DPR rule.

CDPHE and CWCB will collaborate on how to prioritize and support resulting projects (or pilot projects) that help advance reuse initiatives that further the goals of the Water Plan through strategic planning, grant making, and state revolving funds. Specifically, CWCB can continue to play a key role in supporting DPR projects that actualize the new DPR rulemaking and work toward institutionalizing DPR as a safe and necessary tool to meet future water challenges. The CWCB will develop a report on reuse best practices that summarizes effective projects that have been developed and promotes the responsible and targeted adoption of reuse that will seek to identify barriers and opportunities. The resulting Water Reuse Progress Report will identify progress to date on regulations for direct potable reuse as well as non-potable reuse, implementation and barriers to reuse of water across Colorado, potential customer equity issues with different reuse strategies and ways to overcome them, reuse project benefits including quantifying reductions in potable and source water demand, and will investigate next steps to broader implementation of potable and non-potable reuse in Colorado.

### TOOLS used for this action

- Policy and regulatory changes
- Public outreach and education
- Collaboration groups
- Water reuse
- Innovation

### REGULATION 84 (Reclaimed Water Control Regulation)

- 

### REGULATION 86 (Graywater Control Regulation)

- 

### DIRECT POTABLE REUSE

-
1.6 Promote outdoor One Water strategies for integrated land use planning

**Lead Agency:** CWCB

**Collaborating Agencies:** W.V.K.

**Related Action Area:** EI

Land use and water planning integration

Water efficiency and conservation programs

Water reuse

Public outreach and education

Climate adaptation

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**COLORADO GROWING WATER SMART**

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PēU]
Center for Land and Water Policy
ZeMvú of the program. The program consists of a two to three day jvövajv Tap planners, land use planners, and oōvajv evvajv PēPē land use planning. The program jvövajv Tap assistance, and other resources that oojvövajv the range of land use planning tools, oōvajv Tapjvö with forecasted water supplies, and engage their community to jvövajv and policies.

Kvòjvajv Tapjvö Wovvajv PēPē and leaders.

An example of previous CWCB-funded work includes Growing Water Smart Metrics: Tracking the Integration of Water and Land Use Planning.
1.7 Identify turf replacement options that support transformative landscape change

Lead Agency: CWCB

Collaborating Agencies: K >

Related Action Area:
- Resilient Planning

**WHAT IS NON-FUNCTIONAL TURF?**

Part of developing a Colorado standard for landscape would include defining what is and is not functional turf grass. Generally, the term “turf” is often associated with water-intensive grasses, however, not all turf is technically high water-using. The intent of turf removal is really aimed at trying to target removal of high-water using grasses (e.g., Kentucky Bluegrass)—especially where they are providing little value. But defining “low-value” can also be challenging. In the context of this discussion, the focus is on removing high-water-using turf on slopes, in medians, or other locations where alternatives like low-water vegetation, mulch or hard-scapes may reduce water use. At the same time, turf can serve an important function (functional turf), such as high-traffic areas that are used for recreation (e.g., sports fields), municipal operations (e.g., parks, stormwater swales), or for other critical operations.

**WHY CREATE A COLORADO STANDARD?**

States like Nevada or California have made important strides in low-water landscapes; however, the standards and programs used in those states cannot always be easily replicated in Colorado due to important differences in our climates. Nevada or Southern California’s evaporation and transpiration rates (evaporative loss from plants) are significantly higher than Colorado’s. Much of Colorado’s native vegetation surrounding metropolitan areas is grassland, not desert shrubland. Colorado also experiences meaningful seasonal variation in temperature and precipitation. Additionally, Colorado has many native and well-adapted plant materials that provide ecological benefits, societal value, and cooling effects. Often turf removal in other states uses rock, gravel, or other materials that inevitably make landscapes hotter and may not support irrigation that sustains trees—exacerbating warming through the heat island effect.

**TOOLS used for this action**

- Water efficiency and conservation programs
- Collaboration groups
- Public outreach and education
- Equity
- Policy and regulatory changes
1.8 Develop a statewide spatial landscape feasibility assessment for supply and demand drivers

**Lead Agency:** CWCB

**Collaborating Agencies:**

**Related Action Area:**

<table>
<thead>
<tr>
<th>TOOLS used for this action</th>
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<tr>
<td><strong>Land use and water planning integration</strong></td>
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<tr>
<td><strong>Data collection and sharing</strong></td>
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<tr>
<td><strong>Innovation</strong></td>
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At present, there are ongoing efforts in Colorado that offer insights into where CWCB could leverage work and add value:

**Colorado State University (CSU) and Denver Regional Council of Governments (DRCOG):** These groups use spatial technology to assess and measure water demand as it relates to land use type. CSU is creating a methodology for several special districts and water providers to assess how to estimate demands through land use, and DRCOG is mapping its region to include land use type and pervious/impervious area. These kinds of projects will make data more consistent and help water providers understand current water demands and predict future demands more accurately. Stakeholder feedback during the Water Plan scoping period suggested that the state should maintain a land use and water demand database of this sort, help standardize the types of data and formats, and allow ease of access.

**Colorado Airborne Snow Measurement (CASM):** The CASM group, which includes utilities irrigation districts, and NGOs, is supporting ASO technology to measure snowpack. The ASO uses paired airborne LiDAR and imaging spectrometer sensors coupled with a snow dynamics model to measure snow depth and albedo and retrieve snow water equivalent (SWE, or the liquid depth of water stored in the snowpack) across large river basins at a high spatial resolution. The resulting data provides high-elevation snowpack measurements with detail, accuracy, and decision-support value in water management. The added value of these measurements to the water community has been demonstrated through a multitude of pilot flights in Colorado and California. In a 2019 pilot flight series in the Blue River watershed with Denver Water—during a time when the SNOTEL stations in the watershed had melted out—ASO data provided an accurate volume estimate of 115,000 acre-feet of water remaining in the high elevations. This provided Denver Water's operations manager the information needed to accurately reduce Dillon Reservoir levels to account for the incoming runoff, which in turn allowed downstream reservoir operators and other Colorado River reservoir operators to reallocate outflows and cancel Coordinated Reservoir Operations (CROS) that could have otherwise led to downstream flooding and lost water supply. Expanding ASO data collection to cover municipal source water basins on both sides of the continental divide and throughout the state would apply a value-added method to maximizing use of water supplies. Having accurate knowledge of the volume of the water stored in the snowpack in these headwaters provides water managers the information needed to remove much of the “guesswork” from operational decisions.

**Lead Agency:** CWCB

**Collaborating Agencies:**

**Related Action Area:**

**ROBUST AGRICULTURE**
1.9 Develop a study for new and existing water storage opportunities

**Lead Agency:** CWCB  
**Collaborating Agencies:** W, V, TZ

Storage continues to be a critically important tool for meeting current and future water needs and providing flexible management of surface water supplies that are increasingly stressed and altered due to climate change. Storage is also pivotal to managing conserved water and facilitating large-scale implementation of collaborative water sharing agreements. Future storage projects will need to be increasingly collaborative and multi-purpose to the extent possible. New storage projects will have to innovatively identify how to expand existing facilities and minimize evaporation losses while also minimizing environmental impacts. Strategies that store water underground will also need to be considered. Identifying strategies on how storage can be developed quickly, responsibly, and adaptively needs greater research.

The CWCB will leverage existing work, such as the Handbook for Colorado Water Supply Planning and Permitting, DWR’s Colorado Dam Safety Guidelines documents, the Technical Update, Basin Implementation Plans, the Colorado-New Mexico Regional Extreme Precipitation Study, DWR’s Reservoir Enlargement Assessment Project (authorized in 2022 legislation), and other research. The study will also consider the experiences of local governments, communities that have recently permitted and/or negotiated water storage projects, and state agencies involved in permitting water storage projects such as the WQCD, which issues 401 certifications. Ultimately, CWCB will analyze the best opportunities for increasing surface water storage in existing facilities through sediment removal, storage reallocation, dam improvements/enlargements, new surface water storage facility construction, and the use of groundwater aquifer recharge to enhance storage. The final report will include a discussion of where and how to partner with local entities to increase storage through a variety of means. The final report may include opportunities that defer the need for increased storage, such as alternatives like water conservation and CWSAs. The analysis will include conclusions from existing studies, new evaluations, and a review of ongoing permitting challenges and solutions.

**TOOLS** used for this action

- Water storage
- Natural hazard planning
- Innovation
- Data collection and sharing
- Conveyance infrastructure

![Denver Water's Strontia Springs Dam on the South Platte River in Waterton Canyon. Photo credit: Matt Lindburg](image)
1.10 Create a positive discussion space for tough conversations on analyzing transmountain diversion projects in the Technical Update

**Lead Agency:** CWCB

**Collaborating Agencies:** W, VtZ

Data collection and sharing

Policy and regulatory changes

Collaboration groups

Innovation

The Water Plan includes a Conceptual Framework with seven principles to guide future negotiations between proponents of a new TMD, if it were to be built, and the communities and watersheds that would be impacted. The Conceptual Framework remains an important tool for future TMDs if or when they are contemplated. See Chapter 4 for a description of the Conceptual Framework's seven principles.
SUSTAIN PROFITABLE PRODUCTION

Agriculture not only provides food and fiber, but it is also important to Colorado’s culture, heritage, and economy, and it faces unprecedented challenges. Innovations are needed to sustain irrigated agriculture, including strategies to stretch available water supplies, increase resiliency, enhance food production, and maintain profitability.

Water supplies for Colorado’s urban growth should not come at the expense of our rural communities through indiscriminate buy and dry methods. Collaborative partnerships among agriculture, environmental groups, and municipal water providers should be used to create multi-purpose projects that help keep irrigated lands in production and maintain ecosystem services.
PARTNER ACTIONS

The agricultural industry involves individual producers, corporations, and associated private and public providers of support services. These entities have a long history of coming together in partnership to support cooperative projects, outreach, education, and planning. In many cases, grant funding is available to help explore additional work in the areas below.

**Thoughtful Storage**

Storage to protect and enhance existing agricultural uses under future uncertainty: The Technical Update predicts that spring runoff in many areas of the state will experience reduced peaks that occur earlier in the season. This will impact the historical pattern of water available for storage and irrigation delivery. Storage can benefit farmers by allowing them to deliver water at the most beneficial time for the crop versus being limited to seasonally available streamflow.

- Storage to provide supply and flexibility for augmentation plans: Many irrigators rely on groundwater pumping, but associated streamflow depletions must be augmented to prevent injuring senior water rights. Storage provides a source of replacement supply that can be used to augment streamflow when necessary to prevent injury to other water rights.

- Strategic and smaller storage facilities that meet multiple needs: New storage projects at strategic locations many not need to be large to enhance or re-time water supplies to achieve maximum benefit. Often, these smaller storage facilities create operational flexibility while providing ecosystem services and environmental benefits such as new wildlife habitat or recreational opportunities.

SUPPORT FOR ACTION

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- Robust Agriculture
  - Robust Agriculture
    - Thoughtful Storage
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WATER IS OUR LIFEBLOOD IN AGRICULTURE, BUT WATER IS OUR LIFEBLOOD OF THE ENTIRE SOUTHWEST. WITH AGRICULTURE USING MOST OF THE WATER, I THINK IT’S OUR JOB TO BE PART OF THE SOLUTION. IT IS ALL OF OUR FUTURE.

— PAUL BRUCHEZ, CWCB
**Wise Water Use**

Reduced agricultural area does not always need to result in reduced economic output. Colorado is facing a new era of aridity that will require new investment and creativity. This may include investments in protected agriculture agreements, and developing new economic opportunities for producers. Farming and ranching infrastructure can help agriculture be more efficient and protect our existing agricultural economy and irrigated acres. It often requires habitat and food for riparian species, and other flows that support streamflow for fish passage, and providing additional supplies to irrigators while supporting both the environment and working agriculture.

**Measurement of agricultural uses:** Measuring agricultural uses is an important tool for water management. Tools such as conservation easements to preserve wildlife and working agriculture.

**Replacing diversion structures:** Replacing diversion structures can prevent irrigators from diverting all of the water to which they are entitled. In addition, many structures block the passage of fish and recreational boats. Replacing diversion structures:

- Rehabilitating of agricultural storage facilities:
  - Improvements toward more efficient and effective water delivery and use can help producers make better use of modern technologies. Reduction in supplies due to climate change means that producers may have to do more with less. Finding ways to efficiently use available supplies will support these efforts.

- Measurement of agricultural uses:

- Conveyance efficiency improvements:
  - Efforts to repair and rehabilitate these aging systems including water use efficiency, which can benefit crop growth and may increase profitability.

- Lower water use cropping:

- Healthy Lands:

  - Soil health and effective use of water: Healthy soils can increase the resiliency of agricultural operations is critical to a robust agricultural future in Colorado.
• Natural working lands and greenhouse gas emissions: Improved management of farm and range lands through strategies like rotational grazing and cover cropping has the potential to make working lands a sink rather than a source of greenhouse gas emissions. Colorado’s Strategic Plan informs these efforts.

• Reducing erosion and improving water quality: Management practices such as conservation tillage, contour farming, and buffer strips can reduce on-farm erosion and improve water quality.

Partner Actions Rely on Effective Engagement and Education at Different Levels

- Government: Agriculture is intrinsically tied to quality of life in Colorado. Government recognition and promotion of the industry’s importance (including for our Tribes) through public engagement and non-agricultural partnerships will help educate people on agriculture, promote local food production, and support the industry through the tough challenges it faces.

- Quasi-governmental entities, ditch companies, acequias, commodity and trade organizations: Entities like water conservancy and conservation districts and ditch companies can conduct outreach campaigns on various water issues, such as alternatives to buy and dry transfers or strategies to build agricultural resilience, and provide support to irrigators that seek grant funding for water-related project development and implementation. Collaborative groups from acequias to CSU Extension and many more already support the agricultural sector, and engagement among these groups can help bring the Water Plan vision to fruition.

- Residents: Providing pathways for success to the next generation of farmers will help sustain the agricultural workforce and may attract new people to the industry.

INTEGRATION ACROSS ACTION AREAS

- VIBRANT COMMUNITIES
- THRIVING WATERSHEDS
- RESILIENT PLANNING

AGENCY ACTIONS

The CWCB and partnering agencies will take the following actions to support and advance Colorado’s vision for Robust Agriculture. Each action identifies a lead agency, and in most cases, one or more collaborating agencies. The lead agency is directly responsible for completing an action. Collaborating agencies will partner to successfully complete the action by providing guidance or actively staying informed. Both lead and collaborating agencies envision using existing staff and available resources. Collaborating agencies may provide more leadership or support if additional resources become available. In addition, other agencies may be consulted as needed or if resources become available.

2.1 Expand agricultural water conservation, education, and peer-to-peer programs that enhance innovation

**Lead Agency:** CWCB; CDA

**Collaborating Agencies:** N/A

**Related Action Area:** Resilient Planning

**TOOLS used for this action**

- Public outreach and education
- Water efficiency and conservation programs
- Collaboration groups
- Climate adaptation
- Data collection and sharing

Interactive classes are an effective way to equip producers with knowledge and strategies for improving farm and ranch productivity and resilience. Peer networks can increase the adoption of new practices and technology that advance water efficiency and conservation. This type of programming and community building is especially important for new or beginning farmers in a time when many producers are retiring, and new owners and operators are facing unprecedented challenges in water availability.

The CWCB and partners will develop a strategy for expanding agricultural water conservation education and peer-to-peer programming into all major river basins in the state, as well as in unique agricultural systems as needed, like acequias, Tribal water uses, or urban farming. Programming curriculum will include regionally-appropriate water conservation and resilience strategies that may include but are not limited to drought preparedness, irrigation efficiency, water conservation, regenerative agricultural practices, drought-resilient crops and forages, water right abandonment law, and new revenue opportunities.
2.2 Integrate capacity-building efforts to support agriculture

**Lead Agency:** CWCB; CDA  
**Collaborating Agencies:** N/A  
**Related Action Area:** Resilient Planning

Creating a robust and resilient agricultural future in Colorado will require supporting the development of the next generation of agricultural producers and professionals that work in agriculture (e.g., ditch company employees, watershed coordinators, CSU Extension educators). New and diverse perspectives are needed to help solve the many Colorado agricultural challenges. Including new and young farmers and people from previously under-represented groups in agriculture and water is necessary to reach a prosperous agricultural future.

The CWCB and partner agencies, including CDA, will coordinate capacity-building and workforce development efforts. This will include, but is not limited to, increasing and diversifying outreach about the Water Plan Grant Program and coordinating with CDA to identify barriers and opportunities to support new and young farmers through grant programs, internships, and support groups.

**TOOLS used for this action**

- Public outreach and education
- Collaboration groups
- Equity
- Innovation
- Climate adaptation

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2.3 Expand the scale of collaborative water sharing agreements

**Lead Agency:** CWCB; CDA  
**Collaborating Agencies:** N/A  
**Related Action Area:** Resilient Planning

CWSAs are one tool that can be used to maintain agricultural productivity that also benefit municipal, environmental, and recreational users. While momentum on CWSAs has been building through groundbreaking and innovative efforts, significant barriers to implementation remain.

The CWCB will foster the use of CWSAs through grant making and convening conversations about CWSAs with the goals of facilitating knowledge sharing between current and potential CWSA participants, attracting new and diverse CWSA participants, and moving toward larger-scale projects with lower transaction costs. The CWCB will actively support innovative and emerging CWSA concepts while still supporting proven strategies, such as coupling CWSAs with conservation easements. The CWCB will expand partnerships with organizations that have local connections to water users, with the goal of these partners facilitating more CWSA projects and building relationships and trust among water users in municipal, environment, and recreation sectors. The CWCB will develop online resources to increase public awareness about CWSAs and tracking CWSA progress.

**TOOLS used for this action**

- Collaborative water sharing agreements
- Public outreach and education
- Collaboration groups
- Land use and water planning integration
- Innovation
2.4 Streamline collaborative water sharing agreement guidance across agencies

**Lead Agency:** CWCB; DWR

**Collaborating Agencies:** CDA

The CWCB will work with state agencies, including DWR, on developing a CWSA tool box that will help align and streamline guidance on CWSAs across state agencies. The tool box will include guidance on the lease-fallow tool, agriculture-to-agriculture water leases, interruptible water supply agreements, and other information DWR and project partners need to move CWSA projects forward. The CWCB and DWR will also work to develop a more effective means to track CWSA development and implementation, such as through the CDSS.

**TOOLS used for this action**

- Collaborative water sharing agreements
- Policy and regulatory changes
- Public outreach and education
- Data collection and sharing
2.5 Support the integration of robust agriculture into local government planning

**Lead Agency:** CWCB; CDA

**Collaborating Agencies:** DOLA

**Related Action Area:** Vibrant Communities, Resilient Planning

Many of the services provided by agriculture align with local government goals, such as providing jobs, local food, open space buffers between communities, scenic views, and ecosystem diversity. Purposeful incorporation of agricultural considerations into resilience planning can enhance these goals.

The CWCB and local government partners will create and promote a framework of agriculture-informed educational materials that help integrate robust agriculture into local government planning. The goal is to help inform planners and developers who may not have the expertise needed to realize impacts of planning decisions on agriculture. This effort will include, but is not limited to, assembling lessons from communities that have successfully maintained agricultural productivity, considering the needs of agriculture in planning (e.g., agricultural equipment transportation or worker housing), integrating urban agriculture, and preserving irrigated land and open space in areas that are pressured by urbanization.

This effort will also explore how to encourage CWSAs or long-term reliable water leasebacks with farmers to maintain irrigation on municipal-owned lands and identify barriers and opportunities for municipalities to best manage land purchased in water transactions.

**TOOLS used for this action**

- Policy and regulatory changes
- Public outreach and education
- Land use and water planning integration
- Collaboration groups
- Equity
2.6 Assess the economic opportunities of avoided buy and dry to communities, ecosystems, and recreation

**Lead Agency:** CWCB

**Collaborating Agencies:** VWV >

The CWCB and partners will research the primary and secondary impacts of agriculture on rural vitality, including economic outputs, jobs, tax revenue, quality of life, and impact of agriculture on environmental and recreational resources. The goal is to help CWCB, local governments, and stakeholders proactively understand and quantify the potential direct and indirect impacts of reducing irrigated acres or converting agricultural lands to other urban or industrial use. The report on this research will explore equitable solutions for water users that include, but are not limited to, assessing the services agriculture provides for cultural, environmental, and recreational values, and identifying programs, strategies, or policies to actively protect these values. The report will also include strategies to help agriculture maintain existing and vulnerable supplies and will look at potential multi-purpose projects to support both agricultural and environmental/recreational values.

**TOOLS used for this action**

- Data collection and sharing
- Policy and regulatory changes
- Equity
- Innovation
- Climate adaptation

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**BESSEMER FARMLAND CONSERVATION PROJECT**

Nearly a third of the Bessemer Ditch water rights is owned by Pueblo Board of Water Works (Pueblo Water). The Bessemer Ditch irrigates lands in Pueblo County that produce chiles, corn, watermelons, onions, pinto beans, and a variety of organic produce. While Pueblo Water currently leases the water rights back to farmers, it will eventually be needed for municipal purposes. Transferring the water out of agriculture will create risks for farm families, rural communities, and the local economy. The Palmer Land Trust developed an innovative solution to lessen future economic risk by creating a strategy for focusing remaining Bessemer Ditch water supplies on the most productive lands. The strategy uses an innovative legal framework in the water rights decree that allows moving water from marginally productive farmland to the most productive land.

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1 Palmer Land Trust, 2021. Bessemer Farmland Conservation Project
2.7 Engage federal and state partners to streamline assistance for groundwater-dependent regions

**Lead Agency:** CWCB; DCA

**Collaborating Agencies:** DWR

**Related Action Area:**
- Vibrant Communities
- Resilient Planning

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The potential for negative environmental and socio-economic impacts from groundwater depletion is significant in several areas of the state. Federal funding is a critical source of assistance for irrigators faced with reducing their water use in groundwater-dependent basins; however, federal programs can involve substantial paperwork, coordination, and management activities that present a barrier to accessing assistance.

The CWCB will spearhead an effort to make better and more efficient use of federal assistance. This will involve outreach to producers, local water conservancy districts, and other organizations to discuss barriers to accessing federal assistance. The CWCB will then engage federal agencies to explore ways to communicate, support, and/or streamline requirements of existing conservation programs, such as the Environmental Quality Incentives Program (EQIP) and Conservation Reserve Enhancement Program (CREP), NRCS, and BOR's WaterSMART. These engagements will identify how policies and funding procedures can be improved and will result in an improved process and understanding for water conservancy/conservation districts and local stakeholders in attaining federal assistance.

In addition, CWCB will consider how $60 million in funding from the recently-created Groundwater Compact Compliance and Sustainability Fund (SB 22-028) can complement funding from the federal sources listed above to benefit groundwater users in the Republican and Rio Grande Basins.
2.8 Streamline agricultural infrastructure funding

Lead Agency: N
Collaborating Agencies: CPW

- New infrastructure and storage projects are needed by agricultural producers to address current and potential future water shortages. Lack of financial resources for new infrastructure projects and rehabilitation of aging infrastructure is a major barrier to improved water management. Colorado agricultural producers have identified a lack of knowledge about grant opportunities and their requirements, inability to secure matching funds, and shortage of grant writing or grant management expertise and experience as key barriers to attaining funding for agricultural infrastructure improvement projects.

The CWCB, in partnership with other agencies and organizations, will support agricultural producers seeking infrastructure funding. This could include, but is not limited to, coordinating grant-writing workshops, connecting water users to resources and organizations to help with grant writing, or creating a framework for irrigation infrastructure assessments to help ditch companies, water conservation partnerships, and producers identify needed improvements, costs, and potential solutions.

TOOLS used for this action
- Public outreach and education
- Funding
- Policy and regulatory changes
- Collaboration groups

2.9 Assess agricultural impacts and best practices for water quality protection

Lead Agency: N
Collaborating Agencies: CDPHE

- Agricultural producers, state agencies, and research institutions have taken a proactive approach to monitor, research, outreach, and develop best management practices that can improve agricultural water quality. Producers around the state are working to address water quality concerns or deal with poor water quality themselves by investing in adaptive farming and ranching practices like planting buffers and cover crops, switching from flood to sprinkler irrigation, switching to salt-tolerant crops that require minimum or no-till systems, or rotational grazing.

Identifying current and future water quality concerns and solutions is important both for minimizing water quality impacts from farming operations to all water use sectors and for managing on-farm water supplies to maintain profitable, sustainable agriculture.

The CWCB, with partner organizations and institutions such as Colorado State University, will research data and knowledge gained about the impacts of on-farm management practices on water quality. The Water Quality Control Division's Nonpoint Source Program can provide foundational information for this effort. The research will result in a report that identifies key knowledge gaps to address in future research projects and discusses emerging challenges and solutions for agricultural water quality that CWCB can help address.

TOOLS used for this action
- Watershed planning
- Data collection and sharing
- Public outreach and education
- Stream/watershed restoration and enhancement
2.10 Integrate soil health, water conservation, and adaptive practices that increase economic outputs with less water use
ENHANCE WATERSHED HEALTH

Colorado’s watersheds hold the future of our water supply security. Comprehensive water resources planning should incorporate conditions of forests, streams, wetlands, and wildlife habitat. As our state’s water source, the health of watersheds affects agriculture, downstream communities, recreation, tourism, and ecosystem function. Colorado will continue to follow a shared stewardship ethic to plan and implement multi-benefit projects to enhance the health of our watersheds.

What is shared stewardship and how can it integrate planning across watersheds?

The Shared Stewardship Agreement: While shared stewardship is a mindset, it is also a specific agreement that includes the U.S. Department of Agriculture, U.S. Forest Service, and State of Colorado. The Shared Stewardship agreement broadly focuses on managing Colorado’s forests for ecological restoration, recreation, protecting water resources and infrastructure, conserving fish and wildlife, engaging diverse stakeholders, and promoting healthy and safe communities. The Shared Stewardship approach brings together national, regional, state, Tribal, and local stakeholders to plan together, prioritize together, and act together.
Plan help create support tools that partners across the

- Streamflow enhancement (retiming and releases): Releases from water storage can
- Nature-based solutions: Support healthy forests, watersheds, and their
- Flows for boating and flatwater recreation:
- Improving fish passage through replacement of agricultural headgates:

Meeting Future Water Needs

- Rehabilitate streams to improve habitat, reduce erosion, and meet needs: Flow

Examples of these “partner actions” are highlighted below, followed by details on supporting agency actions.
Wise Water Use

**LOW HEAD DAMS**

Low head dams typically range from 1 to 15 feet high. In Colorado, low head dams can be anywhere from 1 to 15 feet high. They typically range from 1 to 15 feet in height. In Colorado, low head dams can be found in a variety of locations, including streams, rivers, and lakes. They are commonly used for various purposes, such as generating electricity, providing flood control, and improving water quality.

**Streamflow and lake level protections for environmental needs:** The CWCB can appropriate water rights for instream

- **Healthy Lands**
  - **Forest health improvements:** Maintain healthy forests can create watersheds that are resilient to natural disasters, provide high-quality water supplies, and can help stabilize forest carbon. Identifying sources where possible. Specific ecosystems such as headwaters, floodplains, and wetlands can be evaluated for their role in supporting healthy ecosystems.

- **Reconnecting floodplains and nature-based solutions:** Watershed health and resource use is strongly linked to water supply systems and their ability to support healthy ecosystems. Effective watershed management requires collaboration among national, regional, state, Tribal, local, and community-level stakeholders. It brings together national, regional, state, Tribal, local, and community-level stakeholders to work together to improve watershed health.

- **Create greater drought, fire, and flood resilience:** A direct relationship exists among the natural environment, health and resource use is strongly linked to water supply systems and their ability to support healthy ecosystems. Effective watershed management requires collaboration among national, regional, state, Tribal, local, and community-level stakeholders. It brings together national, regional, state, Tribal, local, and community-level stakeholders to work together to improve watershed health.

- **Invasive phreatophyte and species removal:** Invasive phreatophyte and species removal can fundamentally alter stream channels and systems. They can also be improved on streams with agricultural and riparian corridor projects, creating habitat connectivity for fish and improving riparian and aquatic habitat. Efforts to remove invasive species can improve stream and watershed health.

- **Healthy lands**

  - **Forest health improvements:** Maintain healthy forests can create watersheds that are resilient to natural disasters, provide high-quality water supplies, and can help stabilize forest carbon. Identifying sources where possible. Specific ecosystems such as headwaters, floodplains, and wetlands can be evaluated for their role in supporting healthy ecosystems.

  - **Reconnecting floodplains and nature-based solutions:** Watershed health and resource use is strongly linked to water supply systems and their ability to support healthy ecosystems. Effective watershed management requires collaboration among national, regional, state, Tribal, local, and community-level stakeholders. It brings together national, regional, state, Tribal, local, and community-level stakeholders to work together to improve watershed health.

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- **Wisdom and water use:** The CWCB can appropriate water rights for instream

  - **Healthy lands**

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Partner Actions Rely on Effective Engagement and Education at Different Levels

Partner and stakeholder engagement is a critical element of successful watershed planning efforts that focus on river health (e.g., SMPs, IWMPs, etc.). Plan development and implementation should be tailored to local stakeholder values, the unique characteristics of watersheds being evaluated, and a real-time evaluation of current conditions that may shift assumed priorities. Projects identified through stakeholder-based watershed planning efforts are often grant-funded and show how local prioritization efforts lead to project advancement. Participation of partners at all levels is necessary to assess, prioritize, and implement watershed improvement projects.

- **Government:** Governmental organizations are well-suited to provide resources that further a community’s understanding of how watershed health fits into the statewide approach to water management. Education and outreach campaigns focused on topics such as river health at a municipal level or understanding where your water comes from can be an effective tool. Governmental organizations can often provide resources in the form of grants.

- **Non-governmental organizations:** Critical partners in watershed planning like NGOs can often help with efforts such as data collection, project implementation, analysis, and education. They can often form strong, trust-based relationships with communities.

- **Residents:** Engaging local residents in thriving watersheds can be achieved through activities such as community science and local watershed groups. Watershed planning relies heavily on the site-specific knowledge and ideas of individuals. Engaging with residents who are not traditionally involved in watershed planning will be key.

**INTEGRATION ACROSS ACTION AREAS**

- **VIBRANT COMMUNITIES**
  - The development of multi-benefit projects that enhance environmental and recreational uses can often enhance municipal supply or improve the quality of life in urban areas. For example, restoring urban stream corridors can provide recreational opportunities, improve habitat, enhance landscape aesthetics, and reduce flooding potential. Improving the quality of stormwater runoff from urbanized portions of watersheds can benefit fish and help protect clean water supplies for downstream water users.

- **ROBUST AGRICULTURE**
  - Efforts to increase fish habitat connectivity and recreational boat passage or improve stream health can have benefits for agricultural users through infrastructure improvements and implementing stream restoration. Shared efforts to improve water quality can benefit multiple sectors. CWSAs can be implemented to enhance flows for environmental and recreational purposes.

- **RESILIENT PLANNING**
  - An ecosystem’s resilience is a measure of its ability to absorb changes and return to similar levels after disturbance. Efforts made to improve watershed and forest health will increase the ecosystem’s ability to effectively respond to environmental changes and natural disasters and enhance water security and quality for downstream communities.
Agency Actions

The CWCB and partnering agencies will take the following actions to support and advance Colorado’s vision for Thriving Watersheds. Each action identifies a lead agency, and in most cases, one or more collaborating agencies. The lead agency is directly responsible for completing an action. Collaborating agencies will partner to successfully complete the action by providing guidance or actively staying informed. Both lead and collaborating agencies envision using existing staff and available resources. Collaborating agencies may provide more leadership or support if additional resources become available. In addition, other agencies may be consulted as needed or if resources become available.

3.1 Develop Colorado River Health Assessment Framework (CoRHAf)

**Lead Agency:** CWCB

**Collaborating Agencies:** W, V, Wt

Stream health assessments are a key component of SMPs (Stream Management Plans) and IWMPs (Interim Water Management Plans). To meet requests from various stakeholders implementing these plans and help bridge a critical knowledge gap, CWCB will develop a new guidance document and workbook that will reside on coloradosmp.org. The framework will help stakeholders approach stream health assessments from a common knowledge base, support local values, and provide a successful approach to completing the assessments. This guidance document will provide an overview of the various concepts for evaluating stream health, engaging stakeholders in the process, and evaluating core data needs related to hydrology, geomorphology, biology, ecology, and regulatory context at watershed and stream-reach scales – information useful for technical experts that would make decisions on prescriptive assessment methodologies. The CoRHAf will be the framework that supports stakeholder engagement and planning that recognizes community values as an important factor in conducting stream health assessments that might normally be based on data and regulatory framework alone.

**TOOLS used for this action**

- Stream/watershed restoration and enhancement
- Flow enhancement and maintenance
- Watershed planning
- Collaboration groups
- Innovation

*East River near Crested Butte, Colorado
Photo credit: Matt Lindburg*
3.2 Create a comprehensive stream construction guide

**Lead Agency:** CWCB

**Collaborating Agencies:** CPW

The CWCB will create a supplemental construction guide for contractors and operators that aims to improve the quality, function, and aesthetic of construction work in stream corridors. The guide will include lessons learned and examples from successful stream restoration projects around the state. Work done in stream corridors should first seek to avoid interference. If deemed necessary, work conducted in stream corridors should come with a high standard to re-naturalize the site.

Finished projects should aim to blend into the natural surroundings. This means thinking beyond the black and white lines on an engineering drawing, using knowledge and skills as a contractor and/or operator to observe how natural sections of stream corridors look and function, and recreating that appearance and functionality as much as possible. Variation and non-uniformity are important themes. Streams are not straight lines and do not have perfect dimensions or consistent spacing.

Techniques for remediating the site to maximize its potential for revegetation after heavy equipment leaves will also be a feature of this practical planning tool. The guide will serve as a living document that can be adapted and updated over time with new types of guidance (e.g., boat ramps, fish passages, etc.).

**Tools used for this action**

- Watershed planning
- Flow enhancement and maintenance
- Stream/watershed restoration and enhancement
- Public outreach and education
- Innovation

Stream enhancement construction in the Charlie Meyers State Wildlife Area Habitat Enhancement Project.

Photo credit: Matt Kondratieff, Colorado Parks and Wildlife
3.3 Create a Wildfire Ready Watersheds framework

**Lead Agency:** CWCB

**Collaborating Agencies:**

**Tools used for this action**

- Natural hazard planning
- Watershed planning
- Policy and regulatory changes
- Data collection and sharing
- Innovation

The CWCB will immediately develop a strategy to address post-wildfire impacts. Wildfire Ready Watersheds is a strategy and program developed by CWCB that provides a proactive approach to address post-wildfire impacts before disaster strikes. Impacts are defined as risks posed by post-fire hazards to community values, such as water supply, life and property, and transportation corridors. Common post-fire hazards include increased runoff, debris flows, hillslope erosion, water quality impairments, flooding, and associated sediment erosion and deposition. The mission of Wildfire Ready Watersheds is to assess the susceptibility of Colorado's water resources, communities, and critical infrastructure to post-wildfire impacts and advance a framework for communities to plan and implement mitigation strategies to minimize these impacts—before wildfires occur. Wildfire Ready Watersheds focuses on creating a statewide post-fire susceptibility analysis as well as a framework that communities can use for watershed-scale planning to address post-fire hazards. Elements of the framework could also be used for communities after wildfires occur, but the focus of Wildfire Ready Watersheds is to mitigate those hazards before major events happen. The susceptibility analysis includes data collection, data development, analysis, mapping, and reporting. This effort will rely on existing and new statewide datasets for wildfire hazards as well as critical values/assets, such as protecting water supplies, at-risk populations, and other infrastructure layers. The goal is to inform a susceptibility analysis that evaluates post-fire hazards and informs pre-wildfire decision making. This will serve to further an understanding of which watersheds will be most susceptible to post-wildfire impacts and where community stakeholders should focus their efforts in their wildfire mitigation efforts.
3.4 Develop a scenario planning methodology for forest health to inform water planning

**Lead Agency:** CWCB  
**Related Action Area:** Resilient Planning  
**Collaborating Agencies:** CSFS

The Technical Update does not include a forest health driver in its methodology, but including this driver could provide a more robust projection of potential future water supply and environmental risks. CWCB commits to creating a science-based process that involves stakeholder input to develop a range of forest health scenarios and to identify data gaps that require further research in order to integrate forest health in the planning scenarios considered in future Technical Updates. This will be an important and critical step to help evaluate and mitigate future risks as they relate to the forest-water-climate nexus.

**TOOLS used for this action:**
- Data collection and sharing
- Land use and water planning integration
- Public outreach and education
- Innovation

3.5 Expand the Fluvial Hazard Zone Mapping Program

**Lead Agency:** CWCB  
**Related Action Area:** Resilient Planning  
**Collaborating Agencies:** DE

The primary objective of Fluvial Hazard Zone (FHZ) mapping is to identify areas that are vulnerable to fluvial geomorphic hazards from riverine erosion, sedimentation, and channel movement and to determine where avoidance and mitigation measures should be focused. FHZ mapping is a science-based method that can be used to define areas that need protection, where mitigation measures can be implemented to protect downstream infrastructure, and to prioritize areas for restoration.

The CWCB will further develop the FHZ Program to support state and local community needs by providing guidance on connecting FHZ mapping to stream management, watershed restoration, and Wildfire Ready Watersheds planning. This can be backed with guidance videos to support technical training as well as general support for communities seeking to use FHZ maps for stream corridor, infrastructure, or natural resource planning. Guidance should also reference infrastructure, land-use practices, and pre- and post-flood mitigation of fluvial hazards. This expansion of the FHZ Program will continue to build from its beginnings as a hazard mapping tool to an expanded recognition of the multitude of benefits these maps can provide to communities looking to manage healthy stream corridors and natural water infrastructure. The CWCB has been and will continue to coordinate FHZ efforts with the State Hazard Mitigation Plan update being conducted by the Colorado Department of Public Safety.

**TOOLS used for this action:**
- Data collection and sharing
- Public outreach and education
- Watershed planning
- Flow enhancement and maintenance
- Natural hazard planning
3.6 Enhance use of Water Plan grant funding for watersheds, environment, and recreation

**Lead Agency:** CWCB

**Collaborating Agencies:** WtUKZ

The Water Plan Grant Program can better support a holistic view of watershed health in terms of recognizing and equally funding environmental projects, watershed projects, applicable forest health projects, and recreation. One way to improve the process is enhanced coordination with CPW and other state agencies in reviewing grant applications and data sharing. Early feedback maximizes potential benefits while mitigating potentially detrimental aspects of projects.

The CWCB will engage with other agencies and help build capacity for groups interested in watershed health-related and recreation-focused studies and projects through Water Plan grants. A variety of example watershed health projects are described in the partner actions for Thriving Watersheds.

Recreation-focused project studies may include evaluating user days; enhancing river access; studying recreational uses and flow needs; studying economic impacts of recreation and reduced recreation due to low flows/high water temperatures; reducing hazards from low-head dams, low bridges, and dangerous diversions; and supporting studies for protecting and enhancing flows for recreation and recreational in-channel diversions.

**Tools** used for this action

- Stream/watershed restoration and enhancement
- Funding
- Watershed planning
- Public outreach and education

**The Del Norte Riverfront Project** was a community-led effort to improve public access, create recreation infrastructure, and enhance aquatic and riparian habitat along the Rio Grande in Del Norte. The overall purpose of the project was to create connectivity between the communities and visitors of the San Luis Valley and the river that sustains them. The new Riverfront Park includes a whitewater playwave, boat ramp, fish habitat structures, pedestrian river access, parking area, an Americans with Disabilities Act accessible picnic shelter, and interpretive signage. In addition to receiving funding from a variety of sources, the Del Norte Riverfront Project was awarded a Colorado Water Plan grant. The project has provided a significant positive benefit to the community of Del Norte and the greater San Luis Valley by creating a welcoming, safe space for community members, boaters, and anglers, while also improving river health.
3.7 Reduce barriers to participation in the Instream Flow Program

**Lead Agency:** CWCB

**Collaborating Agencies:** DWR, CPW

In the face of significant climate stress, the CWCB remains committed to acquiring senior water rights offered on a voluntary basis for ISF use to address the needs of Colorado’s rivers and lakes.

- **Public outreach and education**
- **Endangered and threatened species recovery programs**
- **Collaboration groups**
- **Flow enhancement and maintenance**
- **Collaborative water sharing agreements**
3.8 Develop an interagency watershed planning platform

**Lead Agency:** CWCB

**Collaborating Agencies:** WTV ~ VW,

**Tools**

- Data collection and sharing
- Collaboration groups
- Watershed planning
- Stream/watershed restoration and enhancement
- Innovation

**CWCB’s focus area mapping tool** with other planning tools, such as the Water Quality Nonpoint Source Priority Dashboard and the Healthy Watershed Assessment and Watershed Rapid Assessment Program. X/orylozvPvPvZ](j)zj jv orylozvPvPvZ|j

3.9 Create a framework for prioritizing stream health with local stakeholders

**Lead Agency:** CWCB

**Collaborating Agencies:** CPW

**Tools**

- Watershed planning
- Public outreach and education
- Policy and regulatory changes
- Stream/watershed restoration and enhancement

Building on the collective experience and work of multiple agencies in planning stream, watershed, floodplain, and forest restoration efforts, CWCB will work with partner agencies to develop a common watershed planning platform to help state agencies and the public evaluate local priorities by providing and, where possible, integrating multiple mapping efforts into a single watershed hub for planning information. This includes CWCB identifying how the platform would integrate CWCB’s focus area mapping tool with other planning tools, such as the Water Quality Nonpoint Source Priority Dashboard and the Healthy Watershed Assessment and Watershed Rapid Assessment Program.

There may also be opportunities to incorporate elements of interagency EJ mapping tools, such as Colorado EnviroScreen. Agencies aim to scope this project through interagency coordination and will work to find the initial budget with CWCB, consider stakeholder input needs, and create a plan for next steps that move toward implementation.

The CWCB has traditionally funded 100 percent of the locally identified SMPs and IWMPs that have come in for funding. As of 2021, there were 26 approved SMPs across Colorado. These management plans, developed at the local level, should focus on stream and recreational health and make it a priority. Prioritizing the next geographic regions for management plans (e.g., project implementation) is important, yet what defines local prioritization and how prioritization should occur is not well understood. This results in lost time during planning and has spurred requests for state-level planning to determine priorities. However, local projects need local input, and a static list of priorities is not responsive to shifting hydrology and other impacts from fire, flood, and drought. Developing a process by which local decision makers and stakeholders can evaluate what they prioritize is critical to not only be responsive to shifting risks but also to capturing opportunities that might arise to leverage funding in areas that may not be the first priority but that provide the most significant return on investment for water users and the ecosystem.

The CWCB and the River Network will engage stakeholders to develop a framework that helps identify the range of considerations for evaluating priorities when projects advance and will help support stronger projects coming in. This effort will be supported by other guidance and tools CWCB has developed and is creating. The CWCB will use this information to promote management plans in the identified watersheds and will work with NGOs and other stakeholder groups with experience in management plans to initiate and complete planning processes collaboratively with local water users and to foster implementation of projects identified in planning processes.
3.10 Integrate and facilitate access to water-dependent, native species data

**Lead Agency:** CWCB

**Collaborating Agencies:** CPW

**Related Action Area:** Resilient Planning

**TOOLS** used for this action

- Endangered and threatened species recovery programs
- Data collection and sharing
- Flow enhancement and maintenance
- Stream/watershed restoration and enhancement

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**STREAM MANAGEMENT PLAN RESOURCE LIBRARY**

The Stream Management Plan Resource Library provides users and interested parties with a variety of resources to assist in formulating their own stream management plan. The CWCB will continue to facilitate data sharing and build upon this effort to further assist work geared toward the preservation of water-dependent, native species.

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**FISH BARRIER PROJECTS**

Fish barrier projects are critical to native species conservation and recovery actions by protecting native populations from predators, reducing competition for food, and limiting potential for hybridization and disease. In many cases, they are a key tool that helps avoid the listing of fish species under the Endangered Species Act. Access to the data described in this action can help stakeholders better identify and prioritize projects.
BUILD WATER SECURITY

Water security is critical to the quality of life, environment, and economy of Colorado. The future is uncertain, and Colorado needs to be adaptive and resilient to face the challenges ahead. Water security roadmaps, inclusively developed at a local level and informed by strong state leadership, can identify acute and chronic risks to water supply, integrate local planning strategies, prioritize collaborative solutions, and build adaptive capacity and resilience.

Colorado’s water supplies are vulnerable to risks from climate change, aridification, and the threat of natural disasters, which can disproportionately impact vulnerable communities. An equitable response to address these vulnerabilities requires every person to be at the table. State and local agencies will need to build awareness and engagement in water issues among all Coloradans, especially those that have been historically left out of our water planning processes. This type of inclusive mass engagement is needed to build our state’s resilience across all sectors of water planning.

Coloradans need supportive governmental policies and equitable funding opportunities to help build water-related resilience. Strategic decisions and actions are required to minimize future risks to Coloradans while staying flexible in our responses to new challenges and opportunities. Risks and uncertainties make it critical to increase our resiliency and build comprehensive adaptation strategies for water. State and local planning efforts need to focus on practical adaptive measures, supportive government actions, evaluation of disproportionately impacted areas, and prioritizing resilience using the Colorado Resiliency Framework.

What is a water security roadmap?

Water security roadmaps, inclusively developed at a local level and informed by strong state leadership, can identify acute and chronic risks to water supply, integrate local planning strategies, prioritize collaborative solutions, and build adaptive capacity and resilience.

Colorado Resiliency Framework.

Making deeper connections

Colorado Resiliency Framework.

Link for more information on the Colorado Resiliency Framework.
PARTNER ACTIONS

While CWCB provides funding opportunities, identifies research needs, and collaborates with partners, it cannot achieve Colorado’s vision for Resilient Planning alone. Below are several ways that Colorado water users and managers can see themselves and participate in the Colorado Water Plan. In many cases, grant funding is available to help explore additional work in the areas below.

Thoughtful Storage

- **Flood storage for extremes**: Climate change and urban growth may increase flood risk to property and lives. Flood control structures should be maintained, rehabilitated, or enhanced to provide flood protection according to regulations and standards.

- **Protecting storage from effects of wildfire, debris flow**: Critical storage facilities for water supply are often located in forested areas and need to be protected from sediment and debris flows that result from wildfire. Studies to identify forest areas with critical water supply infrastructure and that are vulnerable to wildfire will be needed to develop plans for protecting infrastructure. Projects that enhance connections between headwater streams and floodplains can improve stream and watershed health and reduce risks from wildfire, flooding, and drought.

- **Storage to build drought resiliency**: Storage, whether on the surface or in groundwater aquifers, provides a way to capture supplies during wet periods for use during dry times. Storage will have an increasingly important role in the future if wet periods occur less frequently (but more intensely) and dry periods last longer. Water releases from storage can benefit all sectors of water use.

Meeting Future Water Needs

- **Integrated planning**: Planning studies of water supply, demand, and needed infrastructure that consider a range of uncertain future conditions will help water providers develop supplies and facilities that are resilient and adaptable.

- **Green infrastructure**: Managing stormwater, such as rain gardens, green roofs, and vegetated swales can slow runoff and improve its quality while creating green spaces in urban areas. Repairing and protecting functioning ecosystems can mitigate risk from natural hazards.

- **Multi-purpose projects for building resiliency**: Multi-purpose projects that benefit more than one sector promote flexibility in operations and responsiveness. Multi-purpose projects better address water supply challenges across municipal, agricultural, environmental, and recreation sectors as they occur. Operational
PARTNER ACTIONS

RESILIENT sector resources.

Wise Water Use

• Accessible water conservation programs and incentives: are translated, and a focus is placed on residents who are drought resilience.

• Water efficiency and drought plans: are appropriate for the community.

• Conservation-oriented outreach and education: and are translated, and a focus is placed on residents who are drought resilience.

Healthy Lands

issues that impact our working lands and how we plan for sector resources.

• Pre- and post-hazard planning for critical infrastructure: sector resources.

• Support for natural and working lands: Strategies

The updated 2020 Colorado Resiliency Framework says the consider the following six resiliency planning sectors as an integrated framework: community, economic, health and social, housing, infrastructure, and watersheds and natural resources.
Partner Actions Rely on Effective Engagement and Education at Different Levels

- **Government**: Drought and water supply resilience can be promoted through embedded local/county/regional water resilience coordinators. Improved messaging and coordination across state, local, and county government agencies can help maximize state resources. Pilot initiatives, contests, or other strategies can create opportunities for safely testing new methods, technologies, or approaches to addressing water challenges. Community certification or recognition programs, training and project development, technical support, funding, and project implementation can all be considered and supported across state agencies.

- **Quasi-governmental entities, nongovernmental organizations**: While NGOs and government groups can often support innovation, creative opportunities to innovate and engage new partners is needed. Often, NGOs or non-profits can help support expanding connections. This can include working with the business community to identify adaptive technologies, identifying insights on adaptive practices by engaging Indigenous partners and cultures, or working with students on innovation challenges. Innovation incubators can be developed to foster innovation around critical Colorado natural resource issues (water, wildfire, forest health) through education, technology accelerators, etc. Water providers, NGOs, and others can implement coordinated water projects, help disseminate grant application information and apply for grants, and seek opportunities to align with other local initiatives to leverage funding and advance the dialogue around water (e.g., connection to local foods, equity, natural hazards, energy). Skill-building programs, such as leadership development or capacity building, can be supported by CWCB grants.

- **Residents**: Water career paths for all levels of income and people can be advanced through STEM (i.e., science, technology, engineering, and mathematics) and other educational opportunities, such as project-based learning and service opportunities for water-related issues. Education programs on risks associated with natural hazards and solutions for mitigating risks can be developed with a focus on people in disproportionately impacted communities.

**RESILIENT PLANNING**

**PARTNER ACTIONS INTEGRATION ACROSS ACTION AREAS**

- **VIBRANT COMMUNITIES**: Water rates can be developed that support low-income communities. Water planning can include focused outreach to disproportionately impacted communities to build greater ability to meet water challenges. Ways to build more inclusivity can be explored to advance equitable community resilience and input. Access to adaptive opportunities and shared resources can be increased. Tap fees and development incentives can be encouraged that promote water savings and smart growth.

- **ROBUST AGRICULTURE**: Rural communities and farmers can be specifically engaged in planning discussions or education programs alongside municipal water providers or residents to help bridge the urban/rural divide. On-farm efficiency improvements that provide resilience in a changing climate can help maintain agricultural profitability and support keeping local food in production. CWSAs with agriculture can provide water supplies for a variety of uses and increase economic resiliency for agricultural producers.

- **THRIVING WATERSHEDS**: Maintaining a balance between recreation activities and watershed health is important. Outdoor recreation opportunities (especially related to water) can be supported and promoted in communities that have historically not participated in these activities. Timed entry to parks can be established to help preserve the natural environment, including protecting riparian areas and waterways from overuse, streambank erosion, etc.
Agency Actions

4.1 Create a capacity-building hub to provide accessible educational opportunities

Lead Agency: CWCB

Collaborating Agencies: V K

Data collection and sharing
Public outreach and education
Funding
Equity

CONNECT PEOPLE TO RESOURCES. CREATE KNOWLEDGE SHARING, BEST PRACTICES TO ENCOURAGE CONVERSATIONS. WE CAN FACILITATE A SPACE TO PLANT SEEDS IN PEOPLE’S MINDS AND ENHANCE CONVERSATIONS. — GREG FELT, CWCB
4.2 Support the long-term stability and impact of Basin Roundtables

**Lead Agency:** CWCB

**Collaborating Agencies:** El

**Related Action Area:**
- Vibrant Communities
- Robust Agriculture
- Thriving Watersheds

**WATER FOR THE 21ST CENTURY ACT**

Established in 2005 through HB 05-1177 (the “Water for the 21st Century Act”), the nine Colorado basin roundtables represent each of the state’s eight major river basins and the Denver metropolitan area. The basin roundtables serve an essential role by providing letters of support for Water Plan grants and directly funding local projects through the WSRF grant program. They also identify local water planning needs and advance education and outreach efforts through their respective BIPs that inform the Water Plan.
4.3 Create a collaborative Colorado Water Plan education and outreach campaign

**Lead Agency:** CWCB  
**Collaborating Agencies:** W, V, W, T, K

Many public outreach and messaging efforts have been launched since the 2015 Water Plan to raise awareness about the importance of water to Colorado. Building on the momentum and efforts of past messaging campaigns, a state-led and Water Plan-branded water education messaging effort will be critical in building awareness around the key water issues Coloradans are facing.

As part of the Water Plan update, CWCB will develop and brand a statewide education and outreach campaign to help reinforce the critical issues and opportunities that the Colorado Water Plan brings to light. This work will include looking at recent state surveys across agencies to help identify knowledge gaps and messaging opportunities that will help reinforce and build on local water knowledge. An interagency tool box of materials will be developed, along with a public outreach campaign that can help organizations, stakeholders, and other partners enhance public awareness. These partnerships and collaboration will help unite CWCB and the nine basin roundtables in sharing consistent, clear, bilingual, and accessible messaging to educate the public on Colorado's most critical water issues.

**TOOLS used for this action**
- Public outreach and education
- Collaboration groups
- Equity

*Rio Grande Basin Tour. Photo credit: Rio Grande Basin Roundtable*
4.4 Support an interagency environmental justice mapping working group

### Lead Agency: CDPHE

**Collaborating Agencies:** CWCB, DOLA

**Related Action Area:**
- Resilient Planning
- Vibrant Communities
- Robust Agriculture
- Thriving Watersheds

#### Tools used for this action
- Public outreach and education
- Data collection and sharing
- Collaboration groups
- Land use and water planning integration
- Equity

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The CWCB will work with other agencies, such as CDPHE, in assembling an interagency EJ and equity working group focused on identifying tools to support disproportionately impacted (DI) communities. One example of this type of mapping tool is CDPHE's *Colorado EnviroScreen*, an interactive environmental justice mapping tool that identifies communities with the greatest environmental health risks statewide. The Colorado EnviroScreen and other interactive mapping tools can be used in drought and watershed planning as well as in grant funding to evaluate and prioritize the greatest needs in especially vulnerable communities, and where funding can make the greatest impact.

Leveraging this interagency work and CDPHE-led Environmental Justice Action Task Force, CWCB will build on the Water Equity Task Force’s work in engaging broader and new communities, including communities of color and low-income communities in water discussions and planning.

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### WATER EQUITY TASK FORCE

In March of 2021, CWCB, DNR, and the Governor created a Water Equity Task Force with a single mission: to help CWCB identify guiding principles around EDI that could inform the Water Plan update. The year-long, 21-member Task Force consisted of nine members from each of the nine basin roundtables, nine members from the community in each of those basins, one member from each of Colorado’s two federally recognized Native American Tribes—the SUIT and UMUT—and a member representing the Acequia community.

The Water Equity Task Force concluded its work and met its mission in creating the following guiding principles:

1. **Promote diversity in career pathways in water-related fields through education and engagement.**
2. **Promote collaboration, new voices, and greater community engagement in water discussions.**
3. **Recognize and address elements of the rural-urban divide but focus on creating the rural-urban opportunity.**
4. **Expand grant opportunities to new audiences.**
5. **Support basin roundtables in facilitating broad community engagement and collaborative solutions.**

Though the Task Force concluded after four meetings and one public workshop, the critical work it has charted will continue. One connected effort is being led by CDPHE in advancing several EJ initiatives in which CWCB is involved.

The Environmental Justice Act (HB 21-1266) was signed into law in July 2021, creating the following entities administered by the CDPHE: the Environmental Justice Action Task Force, Environmental Justice Advisory Board, and Environmental Justice Ombudsperson. The Environmental Justice Action Task Force included 22 members across Colorado and submitted comprehensive recommendations about environmental justice to the Legislature, Governor, and CDPHE in November 2022. A Statewide Equity Office was also created by the legislature in 2022 after the passage of HB 22-1397.
### 4.5 Convene workshops on water and climate vulnerability, adaptation, and resilience

**Lead Agency:** CWCB  
**Collaborating Agencies:** W, VV, K  
**Related Action Area:**  
- sKZuuyv  
- ZuZpPa  
- dZUvPwK

Climate change will have major impacts on both water quality and water availability in Colorado and it is imperative to identify not only the vulnerabilities to climate change but how those impacts may be disproportionately impacting different communities and people. While multiple agencies work on water quality and water quantity issues at the State, the average Coloradan is not aware of agency delineations between water quality and water quantity issues.

The CWCB will host at least two workshops across the state, working with groups such as Western Water Assessment to develop a table-top exercise that can help the State better understand how climate impacts stress water and communities. This effort will help uncover how those impacts are being experienced and where there are disproportionate impacts in communities.

As part of this work, CWCB will consult with other State agencies to identify any additional support or participation that agency partners could provide at these workshops. The resulting feedback will help inform State agency support tools, grant making, and can support an update to the Colorado Climate Change Vulnerability Study. Additionally, this work can help State agencies understand the specific issues the public may feel are best supported by interagency partnerships to provide water quality and water quantity expertise at targeted outreach events.

**TOOLS used for this action**  
- Public outreach and education  
- Collaboration groups  
- Equity  
- Climate adaptation  
- Innovation

### 4.6 Develop an interagency framework for increasing grant funding access and opportunities

**Lead Agency:** CWCB  
**Collaborating Agencies:** W, VV, K  
**Related Action Area:**  
- sKZuuyv  
- ZuZpPa  
- dZUvPwK

Grant making is one of the most effective ways a non-regulatory agency like CWCB can encourage EDI considerations in water projects and programs across the state. Increasing accessibility and reducing barriers to applying to CWCB's grant programs is an ongoing effort important to advancing the mission of CWCB and Colorado Water Plan. The CWCB is continuing to evaluate how capacity can be developed, which was recently supported by the legislature in HB 22-1379.

The CWCB will convene discussions with groups like the Environmental Justice Advisory Board, Outdoor Equity Council, and GOCO to share educational opportunities, identify mechanisms to leverage grant funding across agencies (e.g., allow funding from one agency to serve as match funding for grant requests to another agency), and explore ways to increase accessibility of applications and review processes, all with the goal of using this information to develop a set of best practices for grant-making efforts. Initially this effort will be focused through an EDI lens; however, the best practices and tools will be scalable to speak to larger state grant-making efforts. This effort will build on the local community funding guide published by DOLA and will explore where joint meetings or interagency meetings might produce cross-training that leads to greater collaboration.

Ultimately, this would result in a best practices report that highlights interagency opportunities. The pilot group for this work would involve state agencies or political subdivisions (e.g., GOCO) who have made efforts to integrate EDI principles into their grant-making.

**TOOLS used for this action**  
- Public outreach and education  
- Funding  
- Collaboration groups  
- Data collection and sharing  
- Equity
4.7 Update scenarios

Chapter 6: Vision and Actions for Addressing Colorado’s Risks

RESILIENT PLANNING AGENCY ACTIONS

4.7  Update scenarios
4.8  Update climate adaptation-related decision support tools

The 2015 Colorado Water Plan set an adaptive management framework for future planning activities by describing five potential futures, or scenarios. Each scenario estimated different potential water demand and supply conditions based on drivers such as climate change, population projections, social values, agriculture, and municipal needs. Scenario planning provides flexibility in responding to various future conditions rather than trying to predict the future by looking at the past. Often the differences between scenarios help highlight areas where adaptive measures can help avoid future impacts.

The CWCB will revisit and revise the scenarios in the Water Plan based on targeted stakeholder input, best-available science, and trends in drivers that affect water supplies and demands. This effort will consider adjustments to assumptions in specific scenarios to test future impacts and ensure that information is updated in time for the next Technical Update and, ultimately, future Water Plans.

TOOLS used for this action

- Public outreach and education
- Collaboration groups
- Data collection and sharing
- Climate adaptation

lead Agency: CWCB
related Action Area: Resilient Communities

Lead Agency: CWCB
Collaborating Agencies: DOLA; CDPHE; DHESM
Related Action Area: Vibrant Communities, Robust Agriculture, Thriving Watersheds

Over the last decade, CWCB and other state agencies have developed a suite of climate-related decision support tools, including the Climate Change in Colorado Report, the Colorado Climate Change Vulnerability Study, and the Future Avoided Cost Explorer (FACE hazards). These tools provide information on historic and future climate conditions, impacts, and vulnerability, and offer ideas for adaptation. The findings and underlying data often inform CWCB water supply planning and other statewide planning documents, including the Colorado Resiliency Framework and the Colorado Climate Plan. Given recent extreme events, climate model updates, climate and economic volatility, and a better understanding of the inequities of climate change, much of the information in these tools is now out of date.

The CWCB will support the update of the Climate Change in Colorado Report and explore the potential for updating the Colorado Climate Change Vulnerability Study, FACE hazard, and other related tools in the coming years. The CWCB will update these tools in collaboration with other agencies and partners and consider any related public feedback such as exploring opportunities to incorporate data from CDPHE’s Colorado EnviroScreen and Climate Equity Data Viewer EJ mapping tools. Additionally, CWCB will explore how to improve the accessibility, usability, and uptake of these tools so they speak to a broader audience of Coloradans.

TOOLS used for this action

- Data collection and sharing
- Policy and regulatory changes
- Public outreach and education
- Climate adaptation
- Equity
4.9 Create innovation challenges and explore an innovation accelerator

**Lead Agency:** CWCB

**Collaborating Agencies:** VK/d

To spur innovation and technological advances across the state, CWCB will collaborate with key partners to convene a series of contests or “innovation challenges” for each of the four action areas of the Water Plan: Thriving Watersheds, Robust Agriculture, Vibrant Communities, and Resilient Planning. The goals of these challenges will be to mobilize local partners, inspire and elevate innovative approaches, encourage use of CWCB’s and other grant programs, and foster implementation of Water Plan actions.

The CWCB will strategically build coalitions for each innovation challenge to identify partners, designate appropriate funding, leverage grant funding, or otherwise support and develop the contest scope. This work may include identifying public-private partnerships that can help bring increased attention, funding, and community engagement to these competitions. Conceptual examples of this work could include developing a “river health challenge” for municipalities with urban waterways in each of Colorado’s eight major river basins, a water efficiency innovation challenge in the agricultural sector, a water conservation challenge for cities and towns, or a contest to showcase practical adaptation measures to reduce impacts from climate stressors.

Additionally, to support larger innovation efforts and partner with the business community, CWCB will work with the collaborating organizations, business leaders, and NGOs to explore opportunities for the development of a Colorado Innovation Accelerator. This effort would investigate ways that CWCB and other agencies could support emerging ideas and technologies by convening stakeholders, creating or opening market pathways to test new technologies, making resources available to innovators, sharing funding opportunities, and fostering partnerships that could spur water innovation in Colorado.
4.10 Create a drought resiliency toolkit that can be used to support local planning for water security

**Lead Agency:** CWCB

**Collaborating Agencies:** K > VW, V, W

**Related Action Area:**
- S\(\text{u}\)\(\text{u}\)\(\text{u}\)\(\text{u}\)\(\text{u}\)\(\text{u}\)\(\text{u}\)\(\text{u}\)
- Z\(\text{\bar{u}}\)\(\text{\bar{u}}\)\(\text{\bar{u}}\)

**TOOLS used for this action**
- Public outreach and education
- Climate adaptation
- Natural hazard planning
- Land use and water planning integration
- Equity

HAZARD READY COLORADO: DROUGHT, FIRE, AND FLOOD

WE NEED TO PREPARE FOR THE NEW NORMAL IN RURAL AND URBAN COMMUNITIES.

— Jackie Brown, CWCB
GENERAL WATER PLAN ACTIONS

The first step in updating the Colorado Water Plan begins with evaluating baseline data to determine existing and then future water demands. As part of this analysis, key drivers and trends will be analyzed to evaluate major changes over time, as well as existing and new tools. As part of this effort, technical advisory groups will be assembled to help review the methodologies and assumptions in the modeling.

5.1 Update the Analysis and Technical Update to the Colorado Water Plan

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**TOOLS** used for this action

Data collection and sharing
229

Chapter 6: Vision and Actions for Addressing Colorado’s Risks

The update process allows the Colorado Water Plan to stay responsive to changing conditions, evaluate changing conditions, and create buy-in on the pathways that lead to greater water resilience. Using the data outputs from the Technical Update, elements of the BIP updates, and other stakeholder input, a comprehensive update to the Colorado Water Plan will be completed. As was done before, ongoing stakeholder engagement and a public comment period will help inform the Water Plan update.

5.2 Update the Basin Implementation Plans

**Lead Agency:** CWCB

**Collaborating Agencies:** Em

**Related Action Area:** Em

**TOOLS** used for this action

- Public outreach and education
- Collaboration groups
- Data collection and sharing

5.3 Update the Colorado Water Plan by 2033

**Lead Agency:** CWCB

**Collaborating Agencies:** Em

**Related Action Area:** Em

The update process allows the Colorado Water Plan to greater water resilience. Using the data outputs from the Technical Update, elements of the BIP updates, and other stakeholder input, a comprehensive update to the Water Plan will be completed. As was done before, ongoing stakeholder engagement and a public comment period will help inform the Water Plan update.

**TOOLS** used for this action

- Public outreach and education
- Collaboration groups
- Policy and regulatory changes
5.4 Support Colorado’s Commissioner in the negotiations for the post-2026 reservoir operations

Lead Agency: CWCB
Collaborating Agencies: EI
Related Action Area: EI

Tools used for this action:
- Policy and regulatory changes
- Collaboration groups
- Natural hazard planning
- Water efficiency and conservation programs
- Climate adaptation

5.5 Support ongoing efforts related to the Demand Management Feasibility Investigation

Lead Agency: CWCB
Collaborating Agencies: EI
Related Action Area: EI

Tools used for this action:
- Policy and regulatory changes
- Collaboration groups
- Natural hazard planning
- Water efficiency and conservation programs
- Climate adaptation
5.6 Meet Colorado’s existing water shortages through collaborative multipurpose projects

**Tools used for this action**
- Policy and regulatory changes
- Public outreach and education
- Collaborative water sharing agreements
- Collaboration groups
- Climate adaptation

**Lead Agency:** CWCB  
**Collaborating Agencies:** EI  
**Related Action Area:** EI

5.7 Strategically fund the Colorado Water Plan and find opportunities to leverage funding

**Tools used for this action**
- Funding
- Policy and regulatory changes
5.8 Identify collaborative survey efforts

**Lead Agency:** CWCB  
**Collaborating Agencies:** K > VZK VV /K  
**Related Action Area:**

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The CWCB, CDPHE, CDA, DOLA, and Colorado Resiliency Office (CRO) perform intermittent survey work to help gauge public understanding and help guide education/outreach needs around water issues. The CWCB’s most recent survey was done in 2013 (a summary of findings was noted in the Technical Update). In fall of 2021, CWCB released a new survey that will help gauge change in perceptions over time. Analysis of the questions in the 2021 CWCB survey that pertain to water quality could be helpful to CDPHE. CDPHE is undergoing a similar survey process, which may include opportunities to compare findings and evaluate future processes. Similarly, CDA conducts agricultural attitudes surveys every 5 years that ask questions on water issues, DOLA conducts land use surveys every 5 years that incorporate land use/water planning integration questions, and CRO does a survey of local governments every 2 years. Ideally, information from these agency surveys could support each other and be staggered to eliminate survey redundancy and frequency.

Click here to access the survey report.

**PUBLIC OPINIONS, ATTITUDES, AND AWARENESS ABOUT WATER IN COLORADO: 2021 SURVEY AND FOCUS GROUPS**

- Only 31% of respondents correctly identified that farms and ranches use the most water.
- The top five concerns of respondents were:
  1. Quality of water in your home
  2. Amount of water for Colorado’s cities and towns
  3. Amount of water available for Colorado’s farms and ranches
  4. Water quality in our rivers, lakes, and streams
  5. The condition of underground water pipes, dams, and other water utility infrastructure
- 68% of respondents disagreed that Colorado has enough water for the next 40 years.
- 90% of respondents agreed that we can manage Colorado’s water use by careful development of homes, businesses, and infrastructure.
- 89% of respondents agreed that we need to take action in advance to reduce water use and/or increase water supply to continue to grow Colorado’s economy in the future.

Click here to access the survey report.
5.9 Identify opportunities for integrated water quantity and water quality efforts to better mitigate future risk

Lead Agency: CWCB
Collaborating Agencies: CDPHE
Related Action Area: N/A

5.10 Develop annual operational plans that identify targeted work for CWCB

Lead Agency: CWCB
Collaborating Agencies: N/A
Related Action Area: N/A

TOOLS used for this action

- Watershed planning
- Policy and regulatory changes
- Collaboration groups
- Climate adaptation
- Conveyance infrastructure

Data collection and sharing
CHAPTER 7

MOVING FORWARD—TRACKING PROGRESS and UPDATING THE WATER PLAN
Chapter 7: Moving Forward – Tracking Progress and Updating the Water Plan

The Colorado Water Plan is a living document and is meant to be broad and flexible enough to adapt to changing conditions, major drivers, and significant events over time. The plan addresses today's water challenges, but it is also an adaptive framework that provides agility in the face of future uncertainty. Tracking progress and regularly updating the plan are important to understanding how our water landscape is changing and how the Water Plan needs to adapt.

**TRACKING WATER PLAN ACTIONS**

The Water Plan includes 50 agency actions that CWCB and supporting agencies will advance and that CWCB will track. Sequencing of these actions will be flexible and evaluated annually. Advancement of partner actions will generally be tracked through grants, loans, and other CWCB funded projects, acknowledging that many more actions will stem from and/or support the Water Plan than are within CWCB's ability to track (e.g., private investment, federal funding, projects funded through other state agencies). Annual updates of the Project Database will give the CWCB an additional tool to track progress on projects completed without CWCB support.

**TRACKING PROJECT FUNDING**

Funding projects through grants and loans is an important function of CWCB. Grant and loan funding will be tracked and regularly reported to the CWCB Board. Summary information in CWCB board meeting packets and other required reports (e.g., Water Supply Reserve Fund annual report) include information such as total funded amounts and project information. The CWCB has modernized its grant and loan intake process through an on-line submission portal and database that will aid reporting.

**TRENDS IN WATER RESOURCES DRIVERS**

The CWCB will assess trends in drivers that will impact Colorado's water future during cyclical Technical Updates. During the updates, data and drivers that impact our future water supplies and demands will be assessed to understand how conditions are changing, where resources may need to focus, and how well the state is progressing toward honoring its values and meeting the Colorado vision for each action area (See Chapter 6). For some drivers, long-term trends cannot be properly assessed over short periods with certainty. For example, population, climate, per capita water savings, economic, and hydrologic trends require years of data to identify statistically significant trends.

**PROGRESS**

Tracking Water Plan Actions

Tracking Project Funding

Trends in Water Resources Drivers
The Water Plan Update Process

Colorado recognizes the evolutionary nature of water resources planning and implementation. The two are not mutually exclusive and occur simultaneously at several scales. Colorado’s cyclical, statewide planning is made up of these three phases.

**PHASE 1**
Analysis and Technical Update
Foundational data sets that describe our current and future water supplies and needs

**PHASE 2**
Basin Plan Update
Local planning conducted by basin roundtables that provide grassroots input to the Water Plan

**PHASE 3**
Comprehensive Water Plan Update
Update to the visions and actions in the Water Plan itself

Strategic Implementation
Throughout the Water Plan update cycle, CWCB will focus on:

- Prioritizing projects that have confirmed funds and deadlines.
- Working with the CWCB Board to explore operational plans.
- Coordinating with collaborating agencies and partners to leverage opportunities.
- Supporting legislative actions that arise and direct or inform CWCB.
- Securing funds to complete agency actions and continuing progress.
- Advancing partner actions through CWCB grants, loans and special funds.
- Sequencing interdependent agency actions that help advance future processes.

WATER PLAN UPDATE AND PROCESS SCHEDULE

The Water Plan Update Process

The overall process to update the Water Plan occurs over several years. The CWCB has received and considered stakeholder feedback regarding the process moving forward, including when to initiate the process, ways to streamline the process, and the most important areas for future focus. The CWCB and stakeholders alike have expressed a desire to build in more time for implementation prior to starting the next update. As a result, in the foreseeable future, the Water Plan will be updated on a 10-year cycle, with the next update projected for completion in 2033.

Strategic Implementation
Throughout the Water Plan update cycle, CWCB will focus on:

- Prioritizing projects that have confirmed funds and deadlines.
- Working with the CWCB Board to explore operational plans.
- Coordinating with collaborating agencies and partners to leverage opportunities.
- Supporting legislative actions that arise and direct or inform CWCB.
- Securing funds to complete agency actions and continuing progress.
- Advancing partner actions through CWCB grants, loans and special funds.
- Sequencing interdependent agency actions that help advance future processes.

Between updates, include time to focus on actions:

- Allow time for trends, science, and technology to develop prior to new analysis.
- Pause between updates to allow for other state processes to advance, some of which may have long-term implications (e.g., interstate negotiations).
- Focus on actions that, when completed, build a platform for next steps.

**KEY LESSONS LEARNED**

Several steps are needed to complete each update cycle of the Water Plan. A process for the next update is described below. With each update, CWCB will seek to improve and streamline the process, and a description of the lessons learned from the current process is provided with each of the general steps.
Technical Update (2025–2029)
The last Technical Update used Technical Advisory Groups (TAGs) to help develop methodologies and assumptions used in basin analyses. The process will be repeated in the next Technical Update. Stakeholders and water/natural resource experts who are familiar with Colorado’s river basins, analysis methods, technical findings, and ongoing project tracking invite others to participate with examples that are shown in the partner actions, which are supported by CWCB needs. While not all of these projects will be developed or used in the next Technical Update, key stakeholders to be involved in TAGs help better inform planning scenarios, assumptions, and processes. Stakeholders and water/natural resource experts who are familiar with Colorado’s river basins, analysis methods, technical findings, and ongoing project tracking will help TAGs understand how things may have changed over time and how that informs our response. To facilitate a streamlined Water Plan update, identifying key data findings for basin roundtables to use in discussions with basin experts, and building time for focusing on action in between updates are key. Key lessons learned from this process include:

- CWCB’s Water Plan Grant Program, CWCB Loan Program, etc.
- Technical Update findings will be used in the next Technical Update. Creating this space for better understanding potential basin projects and funding needs.
- Targeting BIP update elements that go into the Water Plan Update (2031–2033) to help develop methodologies and assumptions used in basin analyses. The TAG process will be repeated in the next Technical Update.

Ongoing Project Tracking and BIP Update (2029–2031)
The Project Database is a high-level planning tool for the State Water Plan Update. Water Plan Update (2031–2033) Updating the Water Plan includes scoping, writing, and reviewing the plan. Carving out time for broad stakeholder input is helpful to seeing how the Water Plan can support local efforts; and allows future BIP updates to be as short or shorter than the 2022 BIP Volume 1 documents. In addition, these components offer the most valuable input for informing the Water Plan update.

Focusing on key challenges and strategies for solving shortages alter their goals is key. Focusing basins on how/if technical findings on water conditions on important drivers like climate and population and extend planning horizons. Complete scientific studies that forecast future conditions. Build time for focusing on action in between updates. Ongoing Project Tracking and BIP Update (2029–2031) The Project Database is a high-level planning tool for the State Water Plan Update. Water Plan Update (2031–2033) Updating the Water Plan includes scoping, writing, and reviewing the plan. Carving out time for broad stakeholder input is helpful to seeing how the Water Plan can support local efforts; and allows future BIP updates to be as short or shorter than the 2022 BIP Volume 1 documents. In addition, these components offer the most valuable input for informing the Water Plan update.

Water Plan Update (2031–2033)

Key Lessons Learned
- CWCB needs to set the vision for future work even if it receives but can make statements of support if appropriate.
- CWCB may not be able to act on all the suggestions.
- Agency actions are things CWCB can achieve in the update cycle.
- It can't do the work alone and should not need much focus.
- Basins need CWCB funding, the Project Database can be updated.
- Water Plan Update (2031–2033) Updating the Water Plan includes scoping, writing, and reviewing the plan. Carving out time for broad stakeholder input is helpful to seeing how the Water Plan can support local efforts; and allows future BIP updates to be as short or shorter than the 2022 BIP Volume 1 documents. In addition, these components offer the most valuable input for informing the Water Plan update.
LOOKING FORWARD: A BRIDGE TO ACTION

The Colorado Water Plan sets the **statewide vision for water management** and creates a **framework for action**.

For the State, the Water Plan serves as a call to action through shared leadership, and active partnerships that will be critical to advancing needed solutions.

Coloradans must come together across diverse groups and geographies to implement actions that will move us closer to a more resilient water future.

Education and outreach engages the public, partners, and leaders in integrated water planning to conserve and protect water for current and future generations.

For more information on CWCB, current initiatives, and ways to get involved, visit [cwcb.colorado.gov](http://cwcb.colorado.gov)
• **Aquifer storage and recovery (ASR)** is a water resources management technique for actively storing water underground during wet periods for recovery when needed, usually during dry periods by way of artificial recharge and well extraction.


• **Basin Implementation Plans (BIP)** provide critical input to the Colorado Water Plan. BIPs were developed by basin roundtables and demonstrate how each basin roundtable plans to meet its future municipal, industrial, agricultural, recreational, and environmental needs. The BIPs identify projects and methods to meet future water needs and develop goals and measurable outcomes, needs, constraints, and opportunities in each basin. Data and information from the Technical Update are used by basin roundtables to update their BIPs.

• **Buy and dry** is the process of buying agricultural water rights and subsequently using the water rights for another purpose (typically for municipal or industrial use). The formerly irrigated agricultural lands are "dried up" and no longer irrigated by virtue of the water transfer.

• **Collaborative water sharing agreements (CWSA)**, formerly known as alternative transfer methods (ATM), are innovative and flexible water use agreements between two or more users, typically involving agricultural, municipal, or environmental users. CWSAs are voluntary, temporary, and compensated agreements.

• **The Colorado River Health Assessment Framework (CoRHAF)** helps stakeholders approach stream health assessments from a common knowledge base, support local values, and provide a successful approach to completing the assessments. CoRHAF is described in more detail in Agency Action 3.1.

• **Water conservation** is the minimization of water loss or waste. The goal of water conservation is to use only the amount of water necessary to complete a task or meet a need. Water conservation can be achieved through policies, programs, and practices designed to encourage the use of less water.

• **Consumptive use** is 1.) Any use of water that permanently removes water from the natural stream system; and 2.) water that has been evaporated, transpired, incorporated into products, plant tissue, or animal tissue and is not available for immediate reuse. Colorado State University Extension, *Glossary of Water Terminology*. Fact Sheet No. 4.717. Crop Series | Irrigation.

• **Demand** in a water use context is the amount of water needed to satisfy the needs of agricultural crops or the amount of water requested by municipal or industrial users.

• **Depletions** are the removal of water from surface or groundwater systems at a rate that exceeds that of recharge.

• **Direct potable reuse (DPR)** is defined by CDPHE as a series of processes that produce finished drinking water utilizing a source containing treated wastewater that has not passed through an environmental buffer (e.g., discharged to a natural stream, etc.). Colorado Department of Public Health & Environment (CDPHE), *Direct Potable Reuse Policy*, 10/25/2022.

• **A Diversion** is the removal of water from its natural course or location by canal, pipe, well, or any other means.

• **Diversion demand** is the amount of water that needs to be diverted or pumped to meet the full crop irrigation water requirement for agriculture; or the portion of distributed water attributable to uses typical of municipal systems, including residential, commercial, light industrial, non-agricultural-related irrigation, firefighting, and non-revenue water. Colorado Department of Public Health & Environment (CDPHE), *Direct Potable Reuse Policy*, 10/25/2022.

• **Ecosystem function** relates to the natural processes and interactions between plants, animals, and micro-organisms that occur in ecosystems that affect the conditions and sustainability of the environment.
• **Water efficiency** refers to strategies or technologies that facilitate using less water to accomplish an activity. Low-flow toilets and showerheads are examples of technologies that increase water efficiency. Water efficiency improvements are typically accomplished via engineered products or solutions.

• **Emerging contaminants** are synthetic or naturally occurring chemicals or any microorganisms that are not commonly monitored in the environment but have the potential to enter the environment and cause known or suspected adverse ecological and/or human health effects.

• **Environmental Impact Bonds** are a special type of revenue bond that shifts risk to private investors and can be an effective financing mechanism for maximizing the water supply benefits of water use efficiency and conservation incentives while minimizing the public risk of implementing this strategy to manage water supplies.

• **Environmental justice (EJ)** is the right for all people to have the right to breathe clean air, drink clean water, participate freely in decisions that affect their environments, live free of dangerous levels of toxic pollution, experience equal protection provided by environmental policies, and share the benefits of a prosperous and vibrant pollution-free economy.

• **Equitable, diverse, and inclusive (EDI)** is an environment where all people whatever their gender, race, ethnicity, religion, national origin, age, sexual orientation, gender identity, citizenship status, education, disability, socio-economic status, or any other identity, feel valued and respected.

• **Floodplain alluvial aquifer storage** is where water is recharged into the alluvial aquifer via recharge ponds or wetlands to act as temporary storage that can offset groundwater depletions, attenuate runoff hydrographs, and help sustain wetland or riparian ecosystems.

• **Forest Health** is a measure of the processes and factors that lead to ecological sustainability and the degree to which forests meet human needs.

• **Form-based restoration** can be used to restore as much of the river’s former footprint and functions as possible when there is not room to restore the footprint that a river could occupy or influence in a wide variety of flow conditions due to development and infrastructure. Form-based restoration projects seek to restore or enhance water quality and fish habitat and abundance, and they also increase the stability of banks and stream channel beds.

• **Framework** in the context of the Water Plan, is used to describe either a real or a conceptual structure to serve as a support or guide for resolution to a problem or challenge.

• **Gaps** are calculated as the difference between the amount of water available to meet agricultural or municipal and industrial diversion demands and the full diversion demand. In the context of the Water Plan, gaps are a measure of risk that water shortages may occur in the future if actions are not taken to mitigate the risk. While gaps were calculated for the agricultural, municipal, and industrial sectors, risks in other water sectors were estimated in different ways as described in the Technical Update and Water Plan.

• **Graywater** is household wastewater (e.g., from a sink, bath, laundry) that does not contain serious contaminants (as from toilets).

• **Green infrastructure** filters and absorbs stormwater where it falls. It includes the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evaporate stormwater and reduce flows to sewer systems or to surface waters.

• **Headwaters communities** include unincorporated areas in counties located in Colorado’s mountainous or “high country” regions, which are often where water supply projects have been or may be constructed in the future.
Chapter Glossary

- **The incremental gap** quantifies the degree to which the agricultural gap could increase beyond what agriculture has historically experienced under water shortage conditions.

- **Instream flows (ISF)** are non-consumptive in-channel water rights. In 1973, the Colorado General Assembly authorized CWCB to appropriate and acquire water rights for ISFs for the purpose of preserving and improving the natural environment.

- **Integrated water management plan (IWMP)** framework focuses on water management practices, streamflow, and resulting affects to ecosystems and water uses. IWMPs are broader than stream management plans and consider a wider array of needs and larger groups of stakeholders, including water rights owners and riparian landowners.

- **Land conservation** is generally understood to refer to policies and practices that protect natural land and habitats or return developed land to its natural state. In some contexts, including in this document, the term is also used to refer to maintaining and protecting historical farm and pasture lands.

- **Natural and working lands** are made up of a variety of land use types from forests, wetlands, and grasslands to agricultural and developed lands. The lands can be managed strategically to sequester carbon and enhance ecosystem health as part of the nature-based solutions.

- **Natural hazard planning** is a set of actions and investments that aim to mitigate the impacts of natural hazards such as wildfire, drought, and flooding. Planning includes pre-hazard mitigation activities and hazard response coordination.

- **Natural lake level (NLL)** is a CWCB water right that protects volumes and elevations in naturally occurring lakes to preserve the natural environment.

- **Nature-based solutions** are actions to protect, sustainably manage, or restore natural or modified ecosystems as solutions to societal challenges, like mitigating water insecurity and climate change. Examples of nature-based solutions include protection or conservation of natural areas, reforestation, restoration of wetlands or other habitats, or sustainable management of farms or forests. These actions can increase resilience to threats like flooding and wildfire and can slow climate change by capturing and storing carbon dioxide. Nature-based solutions can be considered in many of the tools suggested in the Water Plan including watershed management, natural hazard planning, and stream/watershed restoration. While there are many terms that are sometimes used interchangeably or in conjunction with Nature-Based Solutions (e.g., natural climate solutions, natural storage, distributed storage, low tech restoration/structures), the Water Plan does not further define or delineate these terms.

- **Non-functional turf**, also known as nonessential turf, is located in areas that receive little if any use (e.g., solely ornamental grass such as that used in medians, tree lawns).

- **One Water Ethic** is an integrated planning and implementation approach to managing finite water resources for long-term resilience and reliability, meeting both community and ecosystem needs. The One Water Ethic is described in more detail in Chapter 6.

- **Process-based restoration** aims to restore dynamic watershed and stream characteristics that reflect those in minimally impacted systems. This type of restoration project can improve water quality, habitat, and stream resilience. Process-based restoration projects benefit streams and protect clean water supplies for municipalities and agriculture.

- **Resiliency** is the ability of water systems to adapt and continue providing adequate levels of service in the face of changing circumstances and drivers.

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• **Recreational in-channel diversion (RICD)** are water rights for recreational boating on natural streams. Only local governmental entities can apply for RICDs, which are required to have control structures like constructed whitewater park features. Flows associated with RICDs are limited to the minimum streamflow necessary for a reasonable recreational boating experience in and on the water.

• **Scenario planning** is a strategic planning process that acknowledges that the future is uncertain, identifies the drivers that affect water supplies and demands, and envisions alternative water futures that reflect the potential variability of drivers. Adaptive management plans can be developed to meet future needs identified in the scenarios.

• **Stream management plans** are data-driven assessments of river health that help communities prioritize how to protect or enhance environmental and recreational assets in their watershed.

• **Stream restoration** is the manipulation of the physical, chemical, and biological characteristics of a stream with the goal of returning natural/historic functions to a former or degraded aquatic resource.

• **Technical Update** is a short-hand way to reference the Analysis and Technical Update to the Colorado Water Plan. The Technical Update is similar to Colorado’s past Statewide Water Supply Initiative (SWSI) efforts but with important differences (see Section 3 of the Technical Update for a comparison to prior SWSI efforts).

• **Water Conservancy Districts and Water Conservation Districts** are located throughout Colorado. The purpose and difference between these organizations can sometimes be confused. Both organizations build and administer water projects, interface with federal agencies, and administer the repayment of project capital and operations and maintenance costs, as well as transit information and coordinate efforts among agencies, political subdivisions, and private citizens and businesses concerning the conservation protection and development of Colorado water. However, conservation districts tend to have a broader focus, and are established by the state legislature. Conservancy districts address more local needs and are established by public petition.

• **Watershed health** is broadly defined as a measure of ecosystem structure and function. Structure refers to species richness (characterized by abundance and diversity), inorganic and organic resources, and physical attributes (including habitat complexity). Function refers to ecosystem processes such as the hydrologic cycle, nutrient cycling, energy flow, and succession. Functional, healthy watersheds are resilient (they are able to absorb and recover from disturbances), infiltrate snowmelt and rain, store and filter it in the soil, and yield clean water to streams and groundwater.

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