



Colorado's Water Supply Future

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SWSI 2010 Mission Statement, Key Findings, and Recommendations

Statewide Water Supply Initiative 2010 Mission Statement

The Colorado Water Conservation Board will help Colorado maintain adequate water supplies for its citizens, agriculture, and the environment. This will be accomplished through a mix of solutions, all of which should be pursued concurrently.

Introduction

There can be no life without water. Water is indeed the life blood of any community; be it the Front Range metropolis or the farming and recreational communities within Colorado. We know that water supplies are not unlimited. Colorado's growth, development, and quality of life depend upon sustainable and secure supplies of water. The Colorado Water Conservation Board (CWCB), governed by a citizen board, is the state agency responsible for looking at this resource from a statewide perspective. Its mission is to conserve, develop, protect, and manage Colorado's water for present and future generations.

A few years ago, the CWCB, with the blessing of the General Assembly, took on the charge to better understand and prepare for Colorado's future water supply needs. In 2004, the CWCB developed the Statewide Water Supply Initiative (SWSI 1), which comprehensively identified Colorado's current and future water needs to the year 2030. SWSI 1 examined a variety of approaches Colorado could take to meet those needs. In 2006, the report was supplemented by SWSI 2 by adding to the technical work on water conservation, alternative agricultural water transfers, and environmental needs.

SWSI 1 implemented a collaborative approach to water resource issues by establishing "basin roundtables"—diverse groups of people who provide input on water issues. The basin roundtables established a grass roots effort for education and collaboration on water planning issues; those efforts were institutionalized in the Colorado Water for the 21st Century Act of 2005. The Act also created a 27-member Interbasin Compact Committee (IBCC) to facilitate conversations within and between basins.

The Act charges the basin roundtables to develop consumptive and nonconsumptive needs assessments and propose projects and methods to meet those needs. The SWSI 2010 update relies on those basin needs assessments and can inform local and regional water

planning efforts; however, SWSI is not intended to replace local project planning or implementation. SWSI 2010 compiles information to develop a common understanding of existing and future water supplies and demands, both consumptive and nonconsumptive, throughout Colorado. Key elements of this update include:

- ◆ Analysis of water supply demands to 2050;
- ◆ Summary of nonconsumptive needs in each basin, as identified by the basin roundtables;
- ◆ Analysis of supply availability in the Colorado River Basin;
- ◆ Implementation elements associated with identified projects, water conservation, agricultural transfers (both permanent and nonpermanent), and development of new water supplies; and
- ◆ Development of estimated costs of implementing water supply strategies.

SWSI 2010 provides a comprehensive picture of Colorado's water needs—now and in the future. The CWCB intends SWSI to be updated and refined every few years. Also, to ensure the local perspective in this report, each basin roundtable will supplement this report with individual basin reports later in 2011. Used as a statewide planning tool, SWSI 2010 provides comprehensive information to water providers, state policy makers, and the General Assembly as they make decisions for accomplishing our next step—to work together on implementing the necessary strategies to meet our near and long-term future water supply challenges. The CWCB, its staff, and I look forward to working with the stakeholders on implementing strategies to meet the identified water needs, and will keep you up-to-date on our continued progress.

Director of the Colorado Water Conservation Board

SWSI 2010 Key Findings

Overall Key Finding

Colorado faces a shortage of water for meeting the state's consumptive and nonconsumptive water needs. In order to meet Colorado's water management objectives, a mix of local water projects and processes, conservation, reuse, agricultural transfers, and the development of new water supplies should be pursued concurrently.

Consumptive Needs

Projected Water Use

The relative proportions of Colorado's agricultural, municipal and industrial (M&I), and self-supplied industrial (SSI) gross water use in 2050 are depicted in **Figure 1**. Agriculture will continue to use the majority of Colorado's water supply, although it is projected to decline from 86 percent today to 82 percent by 2050.

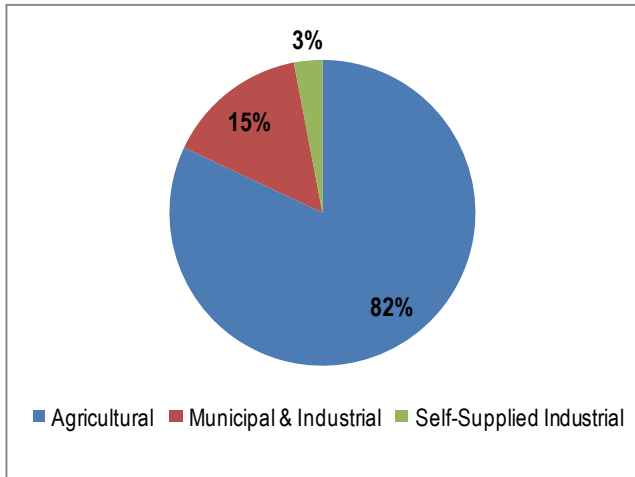


Figure 1. Projected 2050 Water Use by Sector

Agricultural Demands

Each basin faces continued shortages associated with existing agricultural demands. The current agricultural demands and agricultural shortages for each basin are represented in **Figure 2**.

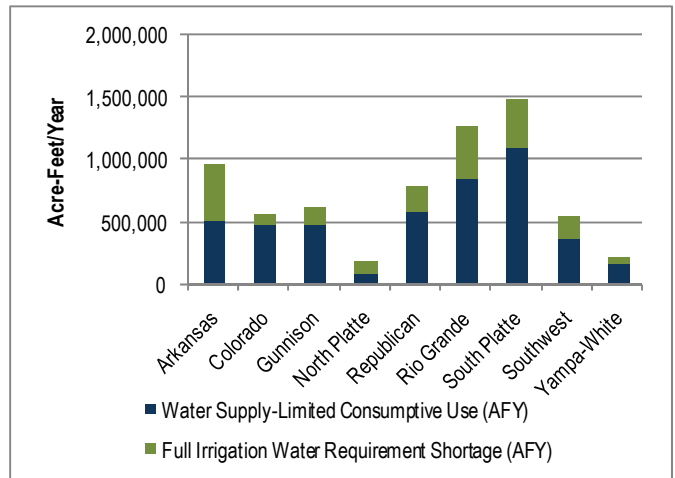


Figure 2. Colorado's Current Agricultural Demands

There are pressures to keep agriculture economically viable, and some basins, such as the Yampa, are seeking to expand agriculture. However, the state could also face a significant decline in irrigated acres by 2050 due to urbanization, water transfers, and market pressures.

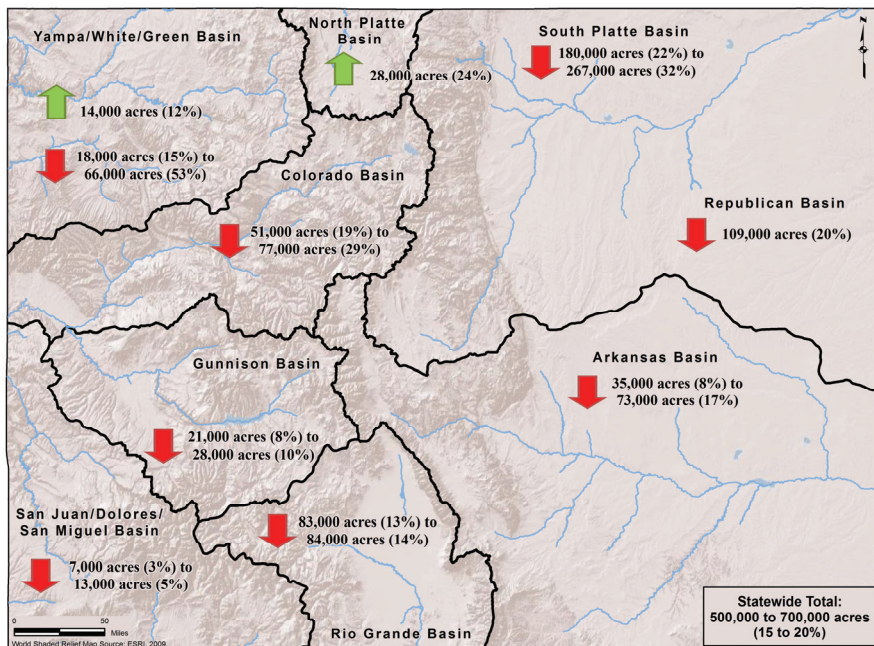


Figure 3. Potential Changes in Irrigated Acres by 2050

As shown in **Figure 3**, between 500,000 and 700,000 irrigated acres could be dried-up by 2050 primarily due to urbanization and urban transfers. Such large-scale dry-up of irrigated agriculture would have adverse economic and environmental impacts.

In 2050, Colorado's agricultural demands are projected to be approximately 4 million acre-feet, compared to 4.8 million acre-feet of current agricultural demand.

SWSI 2010 Key Findings (continued)

Municipal Demands

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

- ◆ Colorado's population is projected to nearly double to between 8.6 and 10 million people by 2050.
- ◆ The Front Range of Colorado will continue to be the most populous place in Colorado with over 80 percent of the state's population residing in the Arkansas, Metro, and South Platte Basins.
- ◆ The West Slope of Colorado will grow at the fastest rate of any area in Colorado between now and 2050. Growth rates on the West Slope are as high as 240 percent, whereas on the Front Range the growth rate is approximately 70 percent. Population on the West Slope is expected to more than double in the next 40 years.
- ◆ Colorado will need between 600,000 and 1 million acre-feet/year of additional M&I water by 2050. This estimate has been adjusted to reflect passive conservation. These estimates incorporate new water demands from population growth, energy and other SSI needs (including oil shale), and replacement of nontributary groundwater.

Statewide M&I and SSI demand projections for each basin are represented in **Figure 4** in acre-feet/year. Per capita water demands have decreased by about 18 percent statewide since 2000; however, the cause and permanency of these savings is uncertain.

Energy Demands

An oil shale industry producing 1,550,000 barrels of oil/day could use between 0 to 120,000 acre-feet/year depending

upon what technologies and other factors are implemented. Due to ramp up rates, by 2050 projected water use ranges from 0 to 44,000 acre-feet/year for an industry providing 550,000 barrels of oil/day. **Figure 5** summarizes projected oil shale water demands in 2050 and at buildout.

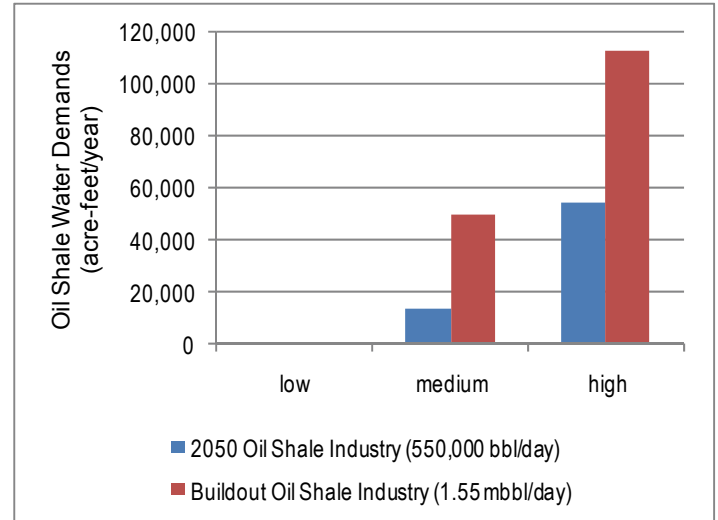


Figure 5. Projected Oil Shale Development Water Demands

Supply

Supply Availability

Supplies are not necessarily where demands are and localized shortages exist, especially in headwater areas. Colorado River compact entitlements are not fully utilized. In the South Platte, Arkansas, and Rio Grande Basins unappropriated water is extremely limited.

The Phase 1 draft of the Colorado River Water Availability Study identified planning ranges for water supply that may be available from the Colorado River system to meet future needs and identified local water availability throughout the Colorado River Basins.

Groundwater Supply

Between now and 2050, decreased reliance on nonrenewable, nontributary groundwater as a permanent water supply is necessary. Otherwise, there are reliability and sustainability concerns in some areas, particularly along the Front Range.

In addition to meeting future M&I water needs, the South Metro area and northern El Paso County will need to replace approximately 35,000 acre-feet/year of nontributary groundwater with a renewable water supply.

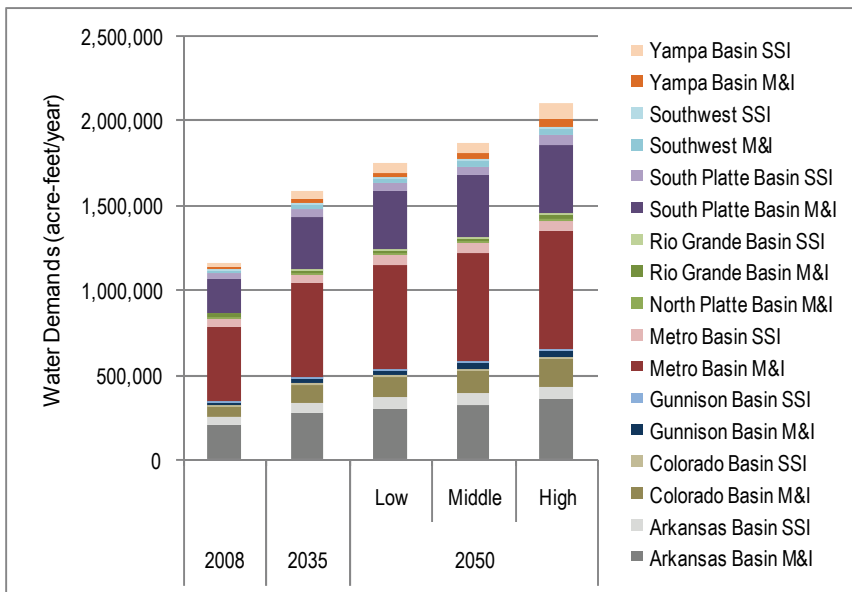


Figure 4. Colorado's Future M&I and SSI Water Demands

Nonconsumptive Needs

Environmental and recreational values will continue to be important to the state's economy and quality of life. **Figure 6** is a summary of each basin roundtable's mapping of their nonconsumptive focus areas. Although Colorado has many existing projects and methods aimed at meeting these nonconsumptive values, additional projects and methods will be needed to meet Colorado's nonconsumptive water supply needs, especially in warmer waters with endangered, threatened, and imperiled species.

- ◆ Nonconsumptive focus areas were identified on 33,000 miles of streams and lakes in the state with water related environmental and recreational values. Nearly

one-third of these focus areas have an identified project or method to support one or more of the nonconsumptive values in the area.

- ◆ The focus areas include 12,000 stream miles that have cold water fisheries (e.g., Cutthroat Trout species and Important Fishing Areas). Of these, nearly 50 percent have an identified project or method to support those values.
- ◆ The focus areas include 11,000 stream miles that have warm water fisheries (e.g., Colorado River endangered fish, and species of special concern, such as Roundtail Chub and Arkansas Darter). Of these, approximately 30 percent have an identified project or method to support those values.

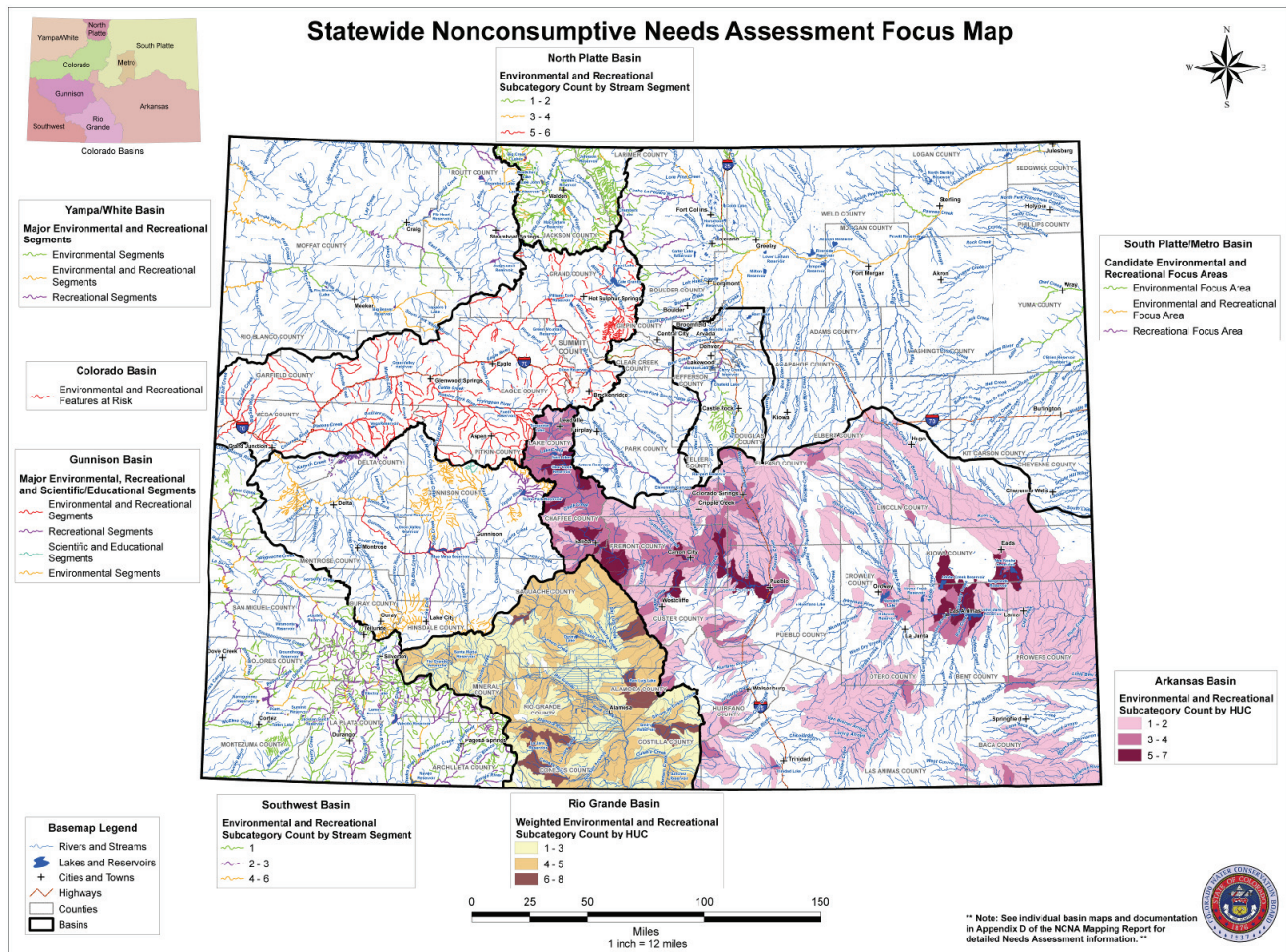


Figure 6. State of Colorado Nonconsumptive Needs Focus Areas

Addressing the M&I Gap

Identified Projects and Processes

As part of SWSI 2010, CWCB gathered more detailed Identified Project and Processes (IPPs) information than was developed for SWSI 1. IPPs are defined as projects and processes local water providers are counting on to meet future water supply needs. The following categories were used:

- ◆ Agricultural water transfers
- ◆ Reuse of existing fully consumable supplies
- ◆ Growth into existing supplies
- ◆ Regional in-basin projects
- ◆ New transbasin projects
- ◆ Firming in-basin water rights
- ◆ Firming transbasin water rights

Note that passive conservation is not included in the categorized IPPs since it is factored into the 2050 demand forecasts. This is consistent with the approach used in SWSI 1.

If 100 percent of the IPPs are successfully implemented they would provide 430,000 to 580,000 acre-feet/year. The largest categories of IPP yields by volume are projected to be regional in-basin projects and growth into existing supplies.

IPPs, if successfully implemented, have the ability to meet some, but not all of Colorado's 2050 M&I water needs. Implementation of these local projects and processes are critical to meeting Colorado's future water supply needs.

M&I Gap

Colorado faces a significant M&I water supply gap in 2050. The M&I gap is defined as the difference between the projected M&I water demands and supplies from existing sources and the supplies from the IPPs. The M&I gap varies between 190,000 and 630,000 acre-feet depending on the success rate of the IPPs. By 2050, Colorado's M&I gap could be between 32 percent and 66 percent of new demands.

The M&I gaps for a medium growth scenario in 2050 are illustrated in **Figure 7** and **Figure 8**. In Figure 8, the size of the pie chart represents new M&I water needs; the relative percent of 2050 new water needs met by IPPs are represented in blue, the percent of gap is represented in red.

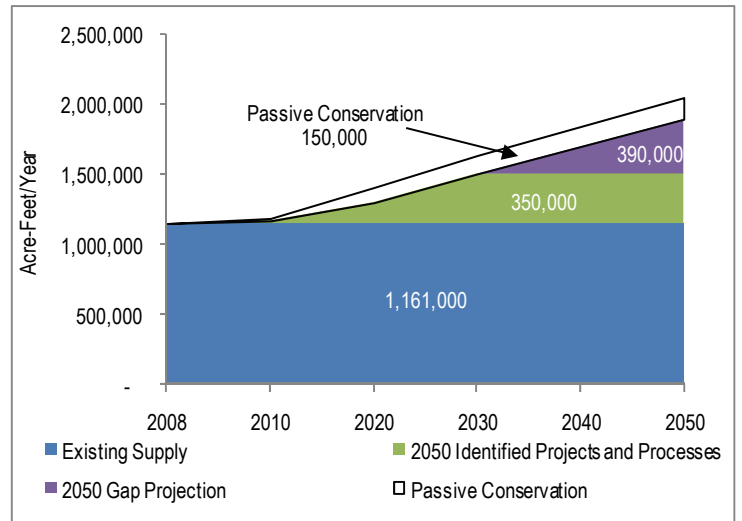


Figure 7. 2050 M&I Gap for Medium Scenario

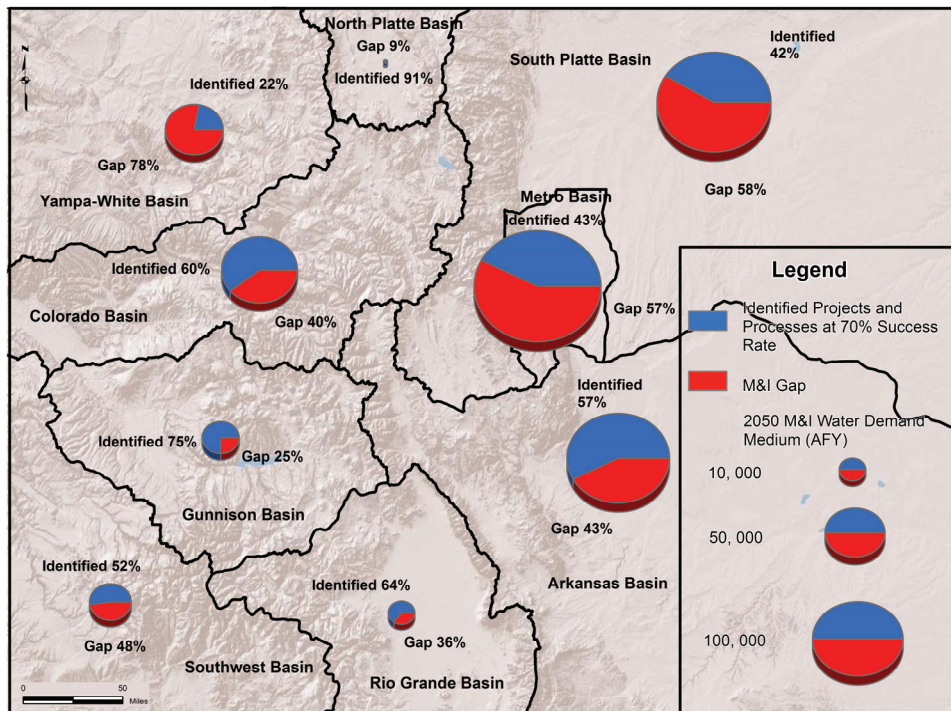


Figure 8. Colorado's 2050 M&I Gaps

Portfolios and Strategies for Meeting the Gap

A mix (i.e., portfolio) of solutions will be necessary for addressing the M&I gap and all elements of the portfolio should be pursued concurrently. This will include the implementation of IPPs, agricultural transfers, new water supply development in the Colorado River system, reuse, and both passive and active conservation as shown in **Figure 9**. No one strategy alone will meet Colorado's future water supply needs, and portfolios explore possible mixes of strategies to weigh the trade-offs that must be made. An example portfolio is shown in **Figure 10**.

Conservation

Water conservation will be one of several important tools for meeting future M&I demands. The SWSI 2010 report provides reconnaissance-level estimates of the statewide water conservation potential. It provides information regarding technical potential for water savings but does not determine how the saved water may be used or how much of the conserved water will be available to meet future needs. This is determined at a local level by water providers taking into account the economic feasibility as well as the political will necessary to accomplish higher savings.

Agricultural water conservation or increasing irrigation efficiency has limited potential to address the M&I gap due to the ability to transfer only the historic consumptive use in most locations due to the requirement that return flow patterns be maintained. There may be some limited opportunities where there are no downstream water right holders (i.e., near the stateline) where more efficient delivery systems (e.g., sprinkler, drip, canal lining) could potentially produce water for other uses.

Land Use Planning

Local entities should consider a closer connection between land use planning and water supply planning with encouragement and support from the state.

New Water Supply Development

New water supplies from the West Slope will be needed for West Slope and Front Range M&I use. How much depends on numerous factors.

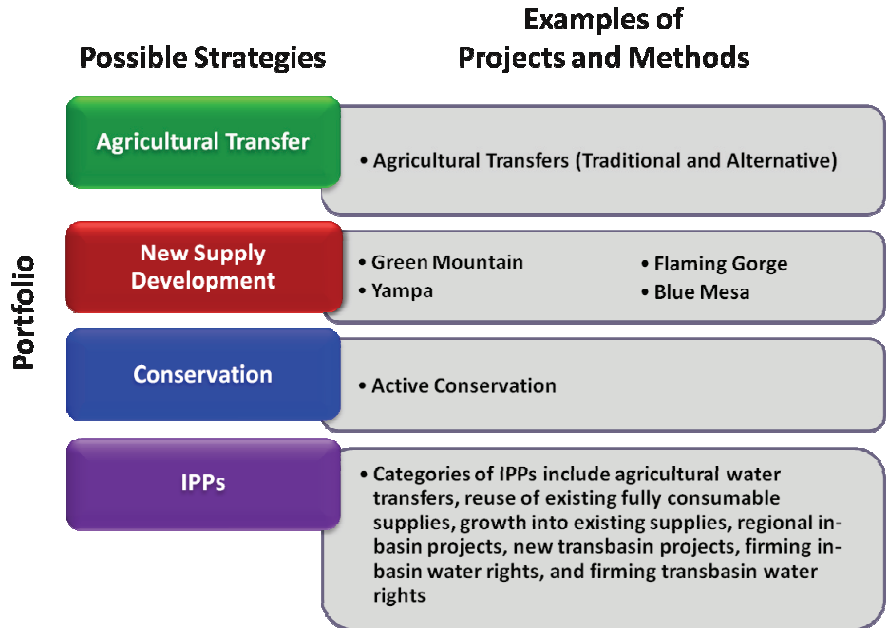


Figure 9. Example Strategies and Projects and Methods to Address Colorado's Future M&I Gaps

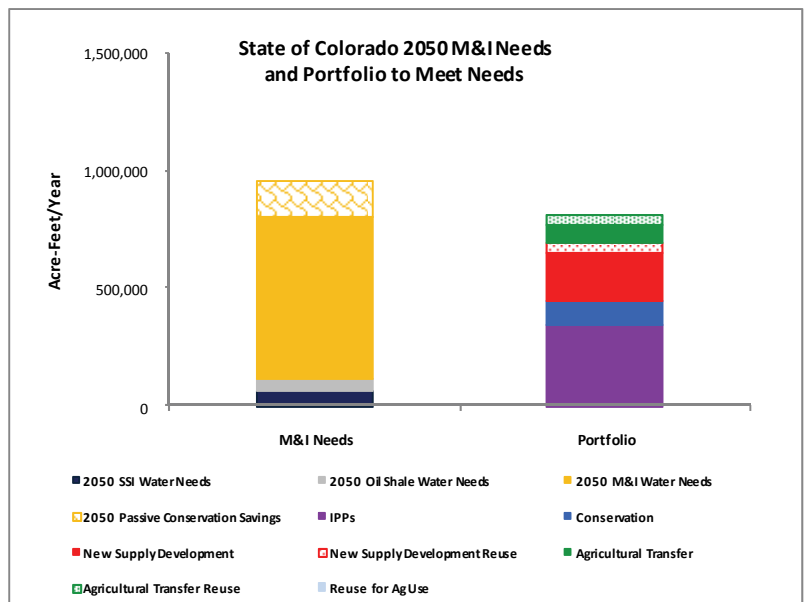


Figure 10. Example Portfolio to Address Colorado's 2050 M&I Demands

Alternative Agricultural Transfers

Alternatives to permanent agricultural water transfers appear to be viable means for meeting a portion of the M&I water supply gap. However, there are significant hurdles to implementing these programs such as high transaction costs, water rights administration, and the certainty of long-term supply for municipalities.

Collaboration

Developing new water supplies in the Colorado River Basin for use on both the East and West Slope can reduce the need for agricultural transfers. This can only be accomplished through continued dialogue. A multi-purpose project could address the consumptive and nonconsumptive water supply needs for the East and West Slope. Water supplies can also be better utilized by water providers working together to seek opportunities for shared facilities and infrastructure.

Water Management Objectives

The Board sees the following as Colorado's water management objectives:

- ◆ Meet M&I Demands
- ◆ Meet Agricultural Demands
- ◆ Meet Colorado's Environmental and Recreational Demands
- ◆ Promote Cooperation Between Water Supply Planners and Land User Planners
- ◆ Promote More Cooperation Among all Colorado Water Users
- ◆ Optimize Existing and Future Water Supplies
- ◆ Promote Cost-Effectiveness
- ◆ Minimize the Net Energy Used to Supply Water
- ◆ Protect Cultural Values Linked to Water Resources
- ◆ Provide Operational Flexibility and Coordinated Infrastructure
- ◆ Promote Increased Fairness When Water is Moved Between Areas
- ◆ Comply With all Applicable Laws and Regulations
- ◆ Educate all Coloradoans on the Importance and Scarcity of Water

Cost of Meeting Future Needs

Meeting Colorado's future water supply needs will require significant investment. Preliminary funding analysis indicates that implementing a portfolio of solutions to address Colorado's 2050 medium M&I water supply needs (approximately an additional 800,000 acre-feet/year) will cost around \$15 billion under status quo assumptions. These costs will increase if Colorado experiences high M&I demands and will decrease if Colorado experiences low M&I demands and implements an alternative portfolio to the "status quo."

The costs associated with the status quo portfolio could be reduced if a coordinated approach, incorporating fewer but larger multi-use projects were used. However, while a coordinated approach would save the citizens of Colorado billions of dollars, it would require a higher level of state involvement including significant state funding.

State funding will continue to be needed to meet agricultural and environmental water supply needs. Without a mechanism to fund environmental and recreational enhancement beyond the project mitigation measures required by law, conflicts among M&I, agricultural, recreational, and environmental users could intensify.

The ability of smaller, rural water providers and agricultural water users to adequately address their existing and future water needs is also significantly affected by their financial capabilities, and many of them rely on state funding to help meet their water supply needs.

Costs for Water Supply Infrastructure

SWSI 2010 analyzed example projects that transport water from the lower South Platte and Arkansas to the Front Range, as well as pumpback projects from the Yampa Basin, Gunnison Basin via Blue Mesa Reservoir, and Green River Basin via Flaming Gorge Reservoir. A reconnaissance analysis of capital costs for these projects range from \$5 to \$9 billion for 250,000 acre-feet of water. The cost for developing 250,000 acre-feet increases if developed incrementally through several smaller projects. The costs presented here represent only one part of the portfolio needed to address Colorado's future M&I demands, and are based on projects that have been discussed in the past but may or may not be implemented.



Gross Reservoir, located in the foothills southwest of Boulder, Colorado

SWSI 2010 Recommendations

Overall Recommendation

With the 2010 SWSI update, CWCB has updated its analysis of the state's water supply needs. CWCB, the IBCC, and basin roundtables should now enter an implementation phase to determine and pursue projects and methods to help meet the state's consumptive and nonconsumptive water supply needs. This will be accomplished through the implementation of the following recommendations by the CWCB.

1. **Actively encourage projects to address multiple purposes, including municipal, industrial, environmental, recreational, agricultural, risk management, and compact compliance needs.**
2. **Identify and utilize existing and new funding opportunities to assist in implementing projects and methods to meet Colorado's consumptive and nonconsumptive water supply needs.**
3. **Continue to lead the dialogue and foster cooperation among water interests in every basin and between basins for the purpose of implementing solutions to Colorado's water supply challenges.**
4. **Support water project proponents and opponents in resolving conflict and addressing concerns associated with implementing IPPs that will reduce the M&I water supply gap. Identify IPPs that could be implemented by 2020.**
5. **Support meeting Colorado's nonconsumptive water needs by working with Colorado's water stakeholders to help:**
 - ◆ **Promote recovery and sustainability of endangered, threatened, and imperiled species in a manner that allows the state to fully use its compact and decreed entitlements.**
 - ◆ **Protect or enhance environmental and recreational values that benefit local and statewide economies.**
 - ◆ **Encourage multi-purpose projects that benefit both water users and native species.**
 - ◆ **Pursue projects and other strategies, including CWCB's Instream Flow Program, that benefit consumptive water users, the riparian and aquatic environments, and stream recreation.**
 - ◆ **Recognize the importance of environmental and recreational benefits derived from agricultural water use, storage reservoirs, and other consumptive water uses and water management.**
6. **Help meet Colorado's agricultural water supply needs by incorporating agricultural water needs into the development of water supply portfolios and supporting the implementation of multi-purpose agricultural water supply projects.**
7. **In order to determine the appropriate combination of portfolios and strategies (IPPs, conservation, reuse, agricultural transfers, and the development of new water supplies) to meet the water supply needs, CWCB will identify what it considers is achievable for each portfolio element and how those portfolio elements could be implemented.**
8. **Evaluate multi-purpose projects or packages of projects to develop new water supplies for use on the West Slope and the Front Range.**
9. **Develop and support risk management strategies so that Colorado can fully use its compact and decree entitlements to best balance Colorado's diverse water needs.**
10. **Support, encourage, and incentivize water providers in planning for and implementing M&I active conservation best management practices and other demand management strategies.**
11. **Work with water providers to identify opportunities where additional water could be made available by increased regional cooperation, storage, exchanges, and other creative opportunities.**
12. **Continue the evaluation of Colorado's water supply availability in all basins to help provide water users with viable analysis tools.**
13. **Help safeguard Colorado's water supply during times of drought by incorporating drought mitigation and response in statewide and local water supply planning.**
14. **Support local water supply planning.**
15. **The CWCB, in consultation with other state agencies, shall develop and implement a plan to educate and promote stewardship of water resources that recognizes water's critical role in supporting the quality of life and economic prosperity of all Coloradoans.**
16. **Establish a 6-year planning cycle for assessing Colorado's long-term consumptive and nonconsumptive water needs and support the implementation of projects and methods to meet those needs.**

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