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Chapter 6: Water Supply Management for the Future

It is the policy of the State of Colorado to encourage grassroots identification of projects and method and to establish next steps for project evaluation and feasibility to close water gaps. By doing so, Colorado will achieve its long term objectives to:

1. Meet Community Water Needs throughout Colorado
2. Meet Colorado's Agricultural Needs
3. Meet Colorado's Environmental and Recreational Needs
4. Meet Colorado's Water Quality Management Needs

INITIAL DRAFT: 6.2 Meeting Colorado's Water Gaps

6.2.1 Overview

Meeting Colorado's water gaps is one of the most essential aspects of Colorado's Water Plan. Because the water plan approach relies on grass root efforts to meet these gaps, analysis of the Draft Basin Implementation Plans (BIPs) is a critical component of this section.

The water plan does not endorse any specific projects. However a combination of projects and methods, as outlined in the BIPs, will be necessary to meet Colorado's current and future municipal, industrial, agricultural, environmental, and recreational needs.

In compiling their BIPs, each Basin Roundtable developed goals and measurable outcomes to assist in determining the types of projects and methods necessary to meet future needs. While a water supply gap for municipal and industrial needs is relatively easy to quantify, the future needs of agriculture, the environment, recreation, watershed health, and other needs are more difficult. The purpose of this section is to describe the Draft BIP goals and measurable outcomes and then identify any remaining needs that must be met to accomplish those objectives by basin, beyond the projects and methods identified for implementation. The remaining needs are referred to as "gaps." The section compares this work with previous technical work conducted in SWSI 2010, the Basin Needs Assessments, and the no and low regrets work and discusses next steps.

6.2.2 Goals and Measurable Outcomes by Basin

The degree to which the Draft BIP goals and measurable outcomes demonstrate concurrence across Colorado is remarkable. CWCB developed several long-term themes that met the objectives outlined in the Governor's executive order [1]. These included:

1. Meet Community Water Needs throughout Colorado
2. Meet Colorado's Agricultural Needs
3. Meet Colorado's Environmental and Recreational Needs
4. Meet Colorado's Water Quality Management Needs

Each of these major themes is reflected in the Draft BIP goals and measurable outcomes. Additionally, the Basin Roundtables identified several other major themes that stemmed across all Draft BIPs. These include:

- Protect and Restore Watershed Health
- Multi-Purpose Storage / Balance all Needs and Reduce Conflict
- Comply with and Manage the Risk Associated with Interstate Compacts and Agreements
- Continue Participation, Education, Outreach, and Communications

Table 6.2-1 demonstrates the common themes found across the eight Draft BIPs, and also shows steps by which the Draft BIPs propose to specifically address these themes.

	Ark	Co		NP	RG	SP/Mt	SW	Y/W/G
A. Meet Community Water Needs Thoughout Colorado								
• *Focus on M&I Gaps*	✓	✓	✓	✓	✓	✓	✓	✓
• *Focus on Conservation / Demand Management*	✓	✓	✓	✓	✓	✓	✓	✓
B. Meet Colorado's Agriculture Needs								
• *Focus on agricultural economy*	✓	✓			✓			
• *Focus on reducing shortages*		✓	✓			✓	✓	✓
• *Improve agricultural efficiencies*	✓	✓	✓		✓		✓	
• *Increase irrigated acres*				✓				✓
• *Conduct the goals while protecting private property rights*		✓	✓	✓		✓	✓	✓
C. Meet Colorado's Environmental and Recreational Water Needs								
• *Focus on recovering imperiled and/or endangered species*	✓	✓	✓	✓	✓	✓	✓	✓
• *Protect wetlands and riparian areas*	✓	✓	✓	✓	✓	✓	✓	✓
• *Protect recreation*	✓	✓	✓	✓	✓	✓	✓	✓
• *Quantify nonconsumptive needs*	✓	✓	✓				✓	✓
H. Meet Colorado's Water Quality Management Needs								
• Includes one or more goals / activities on water quality	✓	✓	✓	✓	✓	✓	✓	✓
D. Protect and Resotre Watershed Health								
• Includes one or more goals / activities associated with watershed health	✓	✓	✓	✓	✓	✓	✓	✓
E. Balance All Needs and Reduce Conflict / Multi Purpose Storage								
• *Protect Private Property Rights / Water Rights*		✓	✓	✓	✓	✓	✓	✓
• *Multi-purpose Focus*	✓	✓	✓	✓	✓	✓	✓	✓
• *Modernizewater infrastructure*	✓		✓	✓	✓			✓
• *Determine how agriculture supports nonconsumptive needs*	✓	✓	✓	✓	✓	✓		✓
• *Increase storage*	✓	✓	✓	✓	✓	✓	✓	✓
F. Comply with Interstate Compacts, agreements, and manage the risk associated with these								
• Includes one or more goals /activities associated with this	✓	✓	✓	✓	✓	✓	✓	✓
G. Continue Participation, Education, Outreach, and Communications								
• Includes one or more goals / activities associated with this	✓	✓	✓	✓	✓	✓	✓	✓

Table 6.2-1 Common themes across Draft BIPs (✓= BIP goal or measurable outcome; ✓= BIP activity)

Below is a brief summary of how the Draft BIPs addressed some of the themes.

Meet Community Water Needs throughout Colorado: Several Draft BIPs, such as those of the Southwest and South Platte basins, focused on implementing already identified projects and processes (IPPs) from SWSI 2010, while other Draft BIPs, such as the Colorado, identified additional projects and methods. In addition the Arkansas, Colorado, South Platte / Metro, and Southwest Basin Roundtables are especially focused on conservation, although all of the Draft BIPs indicate the importance of conservation. Reuse is also important to the Colorado, South Platte, and Arkansas basins.

Meet Colorado's Agricultural Needs: In general, the Arkansas, Colorado, Rio Grande, and Southwest Basin Roundtable's are approaching agricultural needs from an economic and productivity stand point. The North Platte and Yampa/White Basin Roundtables seek to increase their irrigated acres, while several basins, such as the Gunnison and Colorado, seek to reduce agricultural shortages. Nearly every basin is also focused on agricultural efficiencies and modernizing water infrastructure. The South Platte and Metro Basin Roundtables are more concerned about maintaining the viability of agriculture against the pressure of agricultural transfers and urbanization, and are therefore exploring alternative options.

Meet Colorado's Environmental and Recreational Needs: Every Draft BIP discusses the need to recover imperiled and/or endangered species, and protect recreation, wetlands and riparian areas. In addition, several Draft BIPs state the need to further quantify environmental and recreational needs and the Gunnison and Yampa/White/Green Draft BIPs discuss the need to better determine how agriculture supports environmental and recreational values.

Meet Colorado's Water Quality Management Needs: Although water quality is not an issue that has traditionally been a topic that the Basin Roundtables have studied, every Draft BIP addresses Water Quality. The summary of Draft BIP water quality efforts is provided in Section 5.4.

Protect and Restore Watershed Health: While the Arkansas, North Platte, Rio Grande, and Southwest Basin Roundtables are the most focused on watershed health, every Draft BIP recognizes the importance of watershed health. Many Draft BIPs link watershed health to environmental needs or protecting important infrastructure for municipal and agricultural needs. The summary of Draft BIP watershed health efforts is provided in Section 5.3.

Continue Participation, Education, Outreach, and Communications: Every Basin Roundtable has active education and outreach activities, as described in Section 7.5.

While each of the above topics demonstrate a gap associated with the goals and measurable outcomes, there are also several other important themes demonstrated throughout the Draft BIPs that do not involve gaps. Some of these include:

- **Protect Private Property and Water Rights:** All but one Draft BIP makes it clear that solutions to protect agriculture and the environment need to be done in the context of protecting private property and water rights. This general theme is consistent with Colorado's Water Plan.
- **Comply with and Manage the Risk Associated with Interstate Compacts and Agreements:** Every basin in Colorado must grapple with interstate compacts or agreements and each basin has addressed this topic explicitly in its Draft BIP.
- **Multi Purpose Storage and Projects / Balance All Needs and Reduce Conflict:** Every basin has stressed interest in multipurpose projects and approaches. Some, like the Arkansas, Colorado, North Platte and South Platte/Metro Basin Roundtables are interested in how agriculture supports nonconsumptive needs. The Arkansas, South Platte / Metro, Rio Grande, and Southwest Basin Roundtable's goals also explicitly discuss the need for multipurpose projects.

6.2.3 Meet Community Water Needs throughout Colorado

CWCB identified three statewide long-term goals to meet community water needs throughout Colorado [1]:

- Use Water Efficiently to Reduce Overall Future Water Needs
- Identify Additional Projects and Processes to Meet the Water Supply Gap for Communities While Balancing the Needs of Agriculture, the Environment, and Recreation Across the State
- Meet Community Water Needs During Periods of Drought

In addition, through the work of the Basin Roundtables and the IBCC, several no and low regrets goals and measurable outcomes were established, as described in section 5.1. For municipal and industrial uses, example measurable outcomes that would meet these no and low regrets were described for developing IPPs, reuse, conservation, agricultural transfers and Colorado River supplies, and in many cases were broken out by basin [1]:

- *Establish Low/Medium Conservation Strategies*
    - Implement strategies at the basin level to meet medium levels of conservation, and apply half of that to meet the M&I Gap, equivalent statewide to 67,000 acre-feet per year by 2030 and 167,000 acre-feet by 2050.
    - 2050 Conservation Savings by Basin:
        - Arkansas: 36,000 AF
        - Colorado: 15,000 AF
        - Gunnison: 4,300 AF
        - North Platte: 85 AF
        - Rio Grande: 3,200 AF
        - South Platte/Metro: 97,000 AF
        - Southwest: 7,500 AF
        - Yampa/White/Green: 3,700 AF
- *Have a High Success Rate for IPPs*
    - Implement IPPs to yield 80 percent statewide, equivalent to 70,000 AFY for the West Slope and 280,000 AFY for the East Slope
    - 2050 No/Low Regret IPP success by Basin:
        - Arkansas: 76,000 AF
        - Colorado: 45,000 AF
        - Gunnison: 12,000 AF
        - North Platte: 100 AF
        - Rio Grande: 6,000 AF
        - South Platte/Metro: 200,000 AF
        - Southwest: 13,000 AF
        - Yampa/White/Green: 7,000 AF

- *Implement Reuse Strategies*
    - 25,000 acre-feet per year of yield resulting from new agricultural transfer and transmountain diversion projects projects above and beyond the IPPs in the South Platte and Arkansas Basins.
- *Plan and Preserve Options for Existing and New Supply*
    - Develop 35,000 acre-feet per year of new supplies in the Colorado River system for the West Slope.
    - A conceptual agreement is developed between roundtables regarding how to preserve/not foreclose a potential future transbasin diversion from the West Slope to the East. (The Draft Conceptual Agreement developed by the IBCC is discussed in Chapter 6.)

Many of the Draft BIPs seek to accomplish these short and long-term goals, and this subsection reviews information by basin. Table 6.2-2 summarizes the success of each basin in meeting the overall water supply gap for communities and industry.

Basin	2050 New Needs (AF) [2]	2050 Gap (AF) [2]	Potential New AF	# of New Projects w/ AF Info	Are No/Low Regrets Likely Met?	Notes
Arkansas	110,000 - 170,000	45,000 - 94,000	In Process	0	Uncertain: still in process w/ conservation strategy and determining new projects and methods; express need to implement IPPs; will do reuse w/ new development; expresses similar concepts to and discusses conceptual agreement	The Draft Ark BIP will develop additional detail by April 2015 [3]
Colorado	65,000 - 110,000	26,000 - 48,000	510,000 - 540,000	52	Yes: high conservation; some IPP success; identify additional Colorado River Basin supply projects; plans to discuss conceptual agreement	The Colorado identified projects by region, and each region sufficiently meets their M&I gap [4]
Gunnison	16,000 - 23,000	3,700 - 6,100	300	2	Partially: accept conservation standards; some success of IPPs; identify limited amt of additional Colorado River Basin supply projects; expresses similar concepts to conceptual agreement and agree to further engage in future	Draft GU BIP indicates M&I needs "are generally expected to be managed with sufficient existing supplies and/or through planned projects" [5]
Metro / South Platte	340,000 - 505,000	203,000 - 312,000	In Process	6 projects + Portfolios	Partially: largely conceptual, some conservation, some IPP success, additional reuse IPPs, support conceptual agreement in concept	The Draft SP BIP will develop additional detail by April 2015 [6]
North Platte	100-300	10 - 30	N/A	Completed Project	Yes: accept conservation standards; IPP success; does not discuss conceptual agreement	The North Platte has met its municipal gap [7]

Basin	2050 New Needs (AF) [2]	2050 Gap (AF) [2]	Potential New AF	# of New Projects w/ AF Info	Are No/Low Regrets Likely Met?	Notes
Rio Grande	7,700 - 13,000	2,300 - 5,100	None ID'd	0	Partially: little conservation discussion; some IPP success; support conceptual agreement in concept	The Rio Grande did not identify additional acre-feet for municipal projects, but described several potentials [8]
Southwest	20,000 - 31,000	8,800 - 16,000	32,000	7	Yes: conservation policies; high IPP success; develop additional Colorado River Basin supplies; support many aspects of conceptual agreement and indicate conceptual agreement is "in progress"	There is some uncertainty whether identified projects can provide water to where it is needed most within the SW sub-basins [9]
Yampa / White / Green	34,000 - 95,000	24,000 - 83,000	211,000	6	Mostly: some conservation; high IPP success; develop additional Colorado River Basin supplies; discusses some similar concepts to conceptual agreement and will continue to engage	Conducted a thorough M&I shortage analysis, which shows there are still some M&I shortages of up to 10% with climate change [10].

Table 6.2-2. Summary of Draft BIPs addressing the Municipal and Industrial No and Low Regrets and Gaps

Arkansas

The Arkansas Basin faces an immediate municipal gap in some areas, especially if the need to replace nontributary groundwater in El Paso and Elbert counties is taken into account [3]. Future needs in the Arkansas are likely to increase by 110,000 to 170,000 acre-feet and currently planned projects leave a municipal water supply gap within the Arkansas of 45,000 to 94,000 acre-feet. This assumes that identified projects and processes are implemented at a relatively high success rate [2].

Arkansas Goals and Measurable Outcomes:
In order to address this municipal gap, the Arkansas Draft BIP has four goals related to meeting municipal and industrial needs [3]. These goals and the associated measurable outcomes are below:

- Meet the municipal supply gap in each county within the Basin.
    - Generate a study by December, 2015, determining surpluses and deficits within subregions/ counties.
    - Funds provided in support of collaborative efforts reported annually
- Support regional infrastructure development for cost-effective solutions to local water supply gaps.
    - Agreements to regional use of identified IPP's such as Southern Delivery System.
    - New WSRA grant request for regional infrastructure studies.
    - Agreements for off-take of Conduit water; Funding of Conduit processes and construction.
- Reduce or eliminate Denver Basin groundwater dependence for municipal users.
    - Presentations by groundwater dependent entities on solutions that have been implemented.
    - Presentations on interim solutions and funding requests to support those solutions.
    - Funds provided in support of collaborative efforts reported annually.
- Develop collaborative solutions between municipal and agricultural users of water, particularly in drought conditions.
    - Pilot project implemented as reported annually.
    - Engineering template implemented by the Division of Water Resources to expedite temporary transfers at reduced cost.

Meeting the Arkansas' Municipal and Industrial Gaps
The Arkansas is still in the process of exploring additional projects and methods to meet its future municipal needs beyond the identified projects and processes in SWSI 2010 [3]. However, the Arkansas supports development of the four strategies identified during SWSI 2010 [3]:

1. Active and passive conservation;
2. Implementation of all identified projects and processes;
3. Alternatives to agricultural transfers;
4. Development of Colorado River supplies;

As the Draft BIP indicates, "Regional solutions are emerging. A collaborative initiative began in 2009 to define the elements of rotating fallowing of agriculture. The Roundtable moved forward on three tracks simultaneously: technical studies, public policy investigations and pilot projects to test these strategies. A noble effort, however, the efficacy of the outcome remains uncertain. In the meantime, regional solutions in the upper basin are emerging, the lower basin is gaining greater understanding of its challenges and the Pikes Peak region is investigating cooperative infrastructure configurations" [3].

Colorado

The Colorado Basin faces a gap that could begin as early as 2030 in Mesa County [11]. Future needs in the Colorado are likely to increase by 65,000 to 110,000 acre-feet, and currently planned projects leave a municipal water supply gap within the Colorado Basin of 26,000 to 48,000 acre-feet. This assumes that identified projects and processes are implemented at a relatively high success rate [2].

Colorado Goals and Measurable Outcomes:

In order to address this municipal gap, the Colorado Draft BIP has seven goals related to meeting municipal and industrial needs [4]. These goals and the associated measurable outcomes are below:

- Develop land use policies requiring and promoting conservation
    - Develop recommendations for city, county and state governing bodies promoting water awareness and efficiency in land use policy
      Develop educational material or opportunities for municipal and county elected officials and planning officials on water supply issues and conservation options
      Preserve agriculture and reduce the transfer of agriculture water to municipal use
- Raise awareness of current obstacles and efforts facing water providers
    - Publish summary of state and basin water providers' true cost of water by analyzing operation and maintenance costs including sustainable infrastructure replacement programs
    - Development of national, state or local funding assistance programs to replace aging infrastructure
    - All basin water providers have sustainable infrastructure replacement funding programs
- Protect drinking water supplies from natural impacts such as extended droughts, forest fires, climate change, etc
    - Every basin water provider has a reliable redundant water supply to meet 2050 demands
    - CBasin Roundtable or CWCB to establish a biannual basin conference on natural disaster planning for water providers, government officials
- Develop water court process recommendations to encourage efficiency, conservation, and reuse
    - Recommendations to improve the objector process
    - Recommendations to limit vulnerability of water rights when changing existing water rights in water court
    - Improvements to Colorado water law to encourage agricultural water efficiency practices without harming water right value
- Secure growing water demand by developing in-basin supplies and expanding raw water storage supply
    - All basin water providers to meet current supply needs with redundancy, drought plans and viable project options to meet future water needs
    - Reduced average permitting time for reservoir project to under 10 years

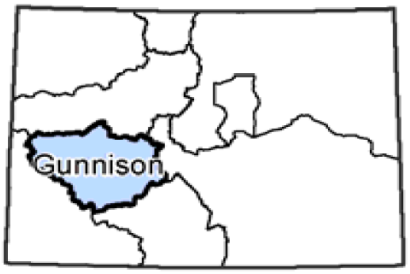
    - Established regional water provider and ditch company cooperatives focused on improving regional relationships, water supply redundancy and flexibility, water quality, coordinated efforts for multi-beneficial projects and addressing environmental and recreational needs
    - Reduce demands by establishing water conservation goals and strategies
- Improve Colorado Water Law to encourage efficiency, conservation, and reuse
    - Revised Colorado Water Law through legislation to allow more flexibility among water providers and agricultural community to promote stream health through conservation, bypass flows, and flexibility in diversion location
    - Reduce time of average Division 5 water court process by adding staff including judges, referees and supporting staff
- Pursue continued municipal and industrial conservation
    - Achieve and sustain a high level of conservation by all basin water providers and industrial users

Meeting the Colorado's Municipal and Industrial Gaps

The Colorado Draft BIP developed an extensive list of potential municipal and industrial projects by interviewing more than sixty water providers throughout the basin [4]. If all of the projects and methods identified were implemented, as a whole the Colorado Basin's municipal and industrial gap would be more than met. The Draft BIP identified 54 potential municipal and industrial projects that quantified the acre-feet. These added up to nearly 510,000 to 540,000 acre-feet, which far exceeds the potential municipal and industrial gap of 48,000 acre-feet identified in SWSI 2010 [2]. In addition, each geographic region identified in the Draft BIP could meet its future needs if the listed projects were implemented [4]. However, there is some uncertainty whether each municipality would be able to access these water supplies and also how viable these projects may be since many of them have not identified a project proponent.

In addition to these projects, the Colorado Draft BIP also advocates for high conservation standards, as identified in SWSI 2010. This would likely result in another 24,000 acre-feet of saved water from active conservation that could be applied to meet future demands. The Draft BIP supports the implementation of conservation best practices and education about land use decisions to support accomplishing high conservation.

In conclusion, if the Colorado River basin was able to implement high conservation and a tenth of the yield identified in the new projects identified, then the municipal and industrial gap should be fully met. However, there is uncertainty regarding the ability for many of the projects to be implemented and specific commitments from water providers to rely on these projects or commit to high conservation levels.



Gunnison

The Gunnison Basin faces a gap that could begin as early as 2035 in Delta County [11]. Future needs in the Gunnison are likely to increase by 16,000 to 23,000 acre-feet and currently planned projects leave a municipal water supply gap within the Gunnison Basin of 3,700 to 6,100 acre-feet. This assumes that

identified projects and processes are implemented at a relatively high success rate [2]. In addition, the Gunnison Draft BIP states that demands in Ouray County may be higher than indicated in SWSI 2010 [5].

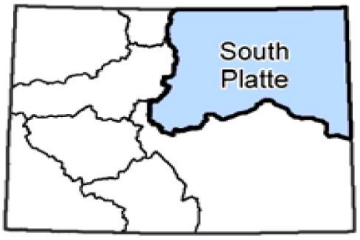
Gunnison Goals and Measurable Outcomes:
In order to address this municipal gap, the Gunnison Draft BIP has one goal related to meeting municipal and industrial needs [5]. That goal and the associated measurable outcomes are below:

- Identify and address municipal and industrial water shortages
    - Reliably meet 100 percent of essential municipal water provider system demands in the Basin through the year 2050 and beyond.
    - Continue the current baseline of effective water conservation programs by covered entities1 in the Basin, producing at least medium levels of conservation savings as defined in SWSI 2010 and employing relevant conservation strategies listed for both the low and medium levels of SWSI 2010

In addition, the Gunnison Draft BIP has the following statewide principle related to municipal conservation, including implementation steps [5]:

- Water conservation, demand management, and land use planning that incorporates water supply factors should be equitably employed statewide.
    - Work with other Roundtables to support conservation, demand management, and the incorporation of water supply factors into land use planning and development.
    - Promote programs that encourage drought tolerant vegetation and discourage lawn irrigation.

Meeting the Gunnison's Municipal and Industrial Gaps
The Basin Roundtable identified two water conservation activities and two projects that were not identified in SWSI 2010 that would help meet future municipal and industrial needs. The two projects would provide approximately 300 acre-feet [5]. While this volume does not fully meet the gap identified in SWSI 2010, the Gunnison Draft BIP states that "Municipal and Industrial needs … are generally expected to be managed with sufficient existing supplies and/or through planned projects" [5]. Given this analysis, the Gunnison Basin's municipal and industrial gap is considered partially met.



Metro / South Platte / Republican

The Metro, South Platte, and Republican Basins face a municipal gap that could begin as early as 2020 in the Lower South Platte [11]. The potential gap in the Lower South Platte is relatively small compared to the urbanized Front Range, which holds the largest gap in Colorado. Future needs in the basin as a whole are likely to increase by 340,000 to 505,000 acre-feet. With existing data, currently planned projects leave a municipal water supply gap within Colorado's northwest region of 203,000 to 312,000 acre-feet. This assumes that identified projects and processes are implemented at a relatively high success rate [2].

South Platte Goals and Measurable Outcomes:
In order to address this municipal and industrial gap, the South Platte Draft BIP developed a long-term goal to meet municipal and industrial needs [6]:

> Meet Community Water Needs throughout Colorado by: 1) Using water efficiently with high levels of participation in conservation programs; 2) Developing additional water throughout the state through balanced, multipurpose projects and methods; and 3) Assuring strong drought protection programs through broad development of protection plans and dedicated reserves potentially including storage, interruptible service agreements (ISAs), water banks, water use restrictions and non-tributary groundwater, etc.

In the short term, the South Platte developed four goals and associated measurable outcomes to meet the large municipal and industrial water supply gap in the South Platte basin [6]:

- Continue the South Platte River Basin's leadership in wise water use.
    - Further quantify the successes of programs implemented in the past several years throughout the South Platte River Basin and establish a general baseline against which the success of future programs will be assessed.
    - Distribute and encourage adoption of "best management practices" as "guidelines" (not standards) for M&I water suppliers to consider in their "provider-controlled" programs recognizing the significant differences in climates, cultures and economic conditions throughout the South Platte River Basin.
    - Maintain and enhance current levels of municipal water reuse and consider studies to quantify the effects of: 1) additional municipal water conservation on water available for reuse; 2) additional municipal water reuse in relation to water available for exchanges; 3) reuse and successive uses of water downstream including effects on agricultural water shortages.
    - Ensure conservation, reuse and drought management plans take into consideration environmental and recreational focus areas and attributes.
- Bring a high percentage of entries in the updated IPP list on-line as a key strategy consistent with the "no/low regrets" scenario planning approach.
    - Maximize implementation of the updated IPP list.
    - Encourage projects that also provide environmental and recreational considerations.
    - Foster opportunities to improve environment and recreation conditions of affected watersheds in association with IPPs.
- To the extent possible, develop multipurpose storage, conveyance, system interconnections and other infrastructure projects to take advantage of limited remaining South Platte supplies and enhance water use efficiencies and supply reliability.
    - Explore opportunities to maximize yield from additional South Platte Basin strategic and multipurpose storage and other infrastructure including collaborative inter-connections between water supply systems and including both above ground and groundwater (e.g. ASR) storage.

    - Encourage multipurpose projects that provide environmental and recreational considerations.
    - Take into consideration environmental and recreational attributes when considering Storage and Other Infrastructure projects and methods.
- Develop agreements governing additional transbasin water imports that: 1) are in accordance with the South Platte Basin's overarching theme that economic and environmental and recreational benefits should equitably accrue to both the West Slope and the East Slope; 2) include project(s) or project elements that provide multiple types of uses; 3) supported with State investment and 4) provide enough certainty in conditions to significantly lessen current trends of traditional buy-and-dry transfers from agricultural uses to M&I uses.
    - Negotiate a conceptual agreement with the West Slope Basin Roundtables on investigating, preserving, and developing potential options so that future multipurpose projects benefiting both slopes can be addressed on a timely basis.
    - Encourage multipurpose projects that provide environmental and recreational considerations.

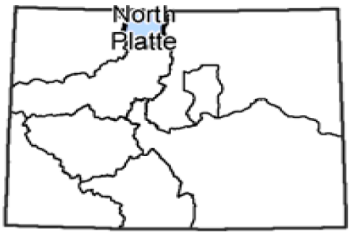
Meeting the South Platte's Municipal and Industrial Gaps

The Draft South Platte Draft BIP developed a list of potential municipal and industrial projects, a conservation strategy, and some initial portfolio development to accomplish these goals and meet the identified municipal and industrial gaps [6]. The South Platte Draft BIP utilized similar categories to the No and Low Regrets work described in Section 5.1 and a comparison is below:

- The Draft BIP partially meets the no and low regrets goals associated with conservation. South Platte Draft BIP applies 36% of Metro and 10% of South Platte active conservation savings plus all of passive savings to meet future needs in their portfolio work. Out of a total of 210,000 acre-feet of quantified potential savings, 110,000 acre-feet is passive, and another 50,000 acre-feet of active conservation savings is applied to future needs. A significantly higher percentage of active conservation would need to be applied to fully meet the no and low regrets goal of applying 197,000 acre-feet to meet new demands.
- The Draft BIP partially meets the no and low regrets goals associated with having a high success rate for the IPPs, indicating a yield of 179,000 acre-feet compared to 199,000 acre-feet identified in the no and low regrets. The no and low regrets action assumed a higher success rate to the IPPs, which includes planned reuse, agricultural transfers, in-basin projects, and transmountain diversions (see below). The South Platte Draft BIP assumes a 60% success rate. In addition the Draft BIP identified a total of six new projects (three for reuse, one agricultural transfer, two in basin projects) that were not previously in SWSI 2010. However, the total amount of IPPs is nearly the same, due to decreases in the yields of other IPPs.
- The no and low regrets indicated that 22,000 acre-feet would need to be generated from new agricultural diversions and any new transmountain diversion projects. Although discussed in the South Platte Draft BIP, no explicit reuse from these new projects were calculated in the Draft BIP's portfolio work.

- The no and low regrets action plan identified the need for 44,000 acre-feet of additional agricultural transfers was needed at a minimum, and states that these transfers should ideally be alternative agricultural transfers. The Draft BIP identified 30,000 acre-feet of alternative agricultural transfer methods (ATMs) and indicated that with conservation applied to meet new demands, between 13,000 and 170,000 of additional traditional agricultural dry-up for portfolios B and C. Therefore, the Draft BIP likely meets this no and low regrets goal.

Additional communication during the finalization of the South Platte Draft BIP will be needed to reconcile the broader level work that went into the no and low regrets work and the South Platte BIP work.



North Platte

The North Platte no longer has a municipal and industrial supply gap. As stated in the North Platte Draft BIP, "The North Platte Basin has only one municipal water provider, the Town of Walden, serving a population of about 600. Limitations to the town's water supply were identified in the original SWSI report, and subsequently addressed through a CWCB-funded study and multi-alternative project, eliminating the only municipal water supply gap in the basin" [7].

North Platte Goals and Measurable Outcomes:
Nonetheless, the Draft BIP indicated support for municipal conservation, which could help meet any additional needs. This goal and associated measurable outcome are below:

- Support the equitable statewide application of municipal water conservation.
    - Comply with future statewide municipal conservation strategies and any related legislation by 2020 or as appropriate.

Meeting the North Platte's Municipal and Industrial Gaps
In summary, the North Platte's future municipal and industrial needs are likely fully met by 2050.

Rio Grande

The Rio Grande Basin faces a gap that, although small, could begin as early as 2025 in Costilla County [11]. Future needs in the Rio Grande are likely to increase by 7,700 to 13,000 acre-feet and currently planned projects leave a municipal water supply gap within the Rio Grande Basin of 2,300 to 5,100 acre-feet. This assumes that identified projects and processes are implemented at a relatively high success rate [2].

Rio Grande Goals and Measurable Outcomes:
In order to address this municipal gap, the Rio Grande Draft BIP identifies three primary goals related to meeting municipal and industrial needs. These goals and the associated measurable outcomes are below [8]:

- Operate, maintain, rehabilitate and create necessary infrastructure to meet the Basin's long-term water needs, including storage.
    - A database of existing water infrastructure including documentation of infrastructure condition and mapping of all storage reservoirs and major ditch diversions is created.
    - Reservoirs operate at full design capacity without restrictions.
    - Diversion structures and conveyance systems function optimally.
    - Municipal potable water supplies are adequate to meet needs.
    - Water supplies and wastewater treatment systems are fully functional and meet all necessary standards.
- Support the development of projects and methods that have multiple benefits for agricultural, municipal and industrial, and environmental and recreational water needs.
    - Opportunities for multiple use benefits have been explored and implemented where possible.
    - Multiple-purpose projects will have preference in the funding process.
- Meet new demands for water, to the extent practicable, without impacting existing water rights and compact obligations.
    - Minimize per capita per day use to a reasonable level.
    - Inventory existing and anticipated future M&I and environmental and recreational water needs.
    - Add hydropower electrical generating capacity where possible.
    - Develop a M&I plan that addresses water needs, availability and a strategy for meeting the needs for M&I while sustaining agricultural water use and minimizing impacts to other uses.

Meeting the Rio Grande's Municipal and Industrial Gaps

The Rio Grande identified very few municipal projects beyond the identified projects and processes in SWSI 2010, and none of these indicated additional acre-feet to meet these growing municipal needs. The Draft BIP recognizes this by stating:

> While M&I and SSI water use will remain a small percentage of overall Basin water use, it is important to provide additional resources to M&I water providers to assist them in meeting future needs by identifying and assisting in the development of:
>
> - Measures to manage water demands and return flows and develop methods to receive augmentation credits for wastewater discharges and lawn irrigation return flows.
> - Water rights, storage and augmentation supplies, either directly or through the groundwater management subdistricts [8].

Because of this, the Rio Grande has not yet determined how it will meet its future municipal and industrial gap.

Southwest

The Southwest Basin faces a gap that could begin as early as 2015 in Montrose County [11]. Future needs in the Southwest Region are

likely to increase by 20,000 to 31,000 acre-feet, and currently planned projects leave a municipal water supply gap within the Southwest region of 8,800 to 16,000 acre-feet. This assumes that identified projects and processes are implemented at a relatively high success rate [2].

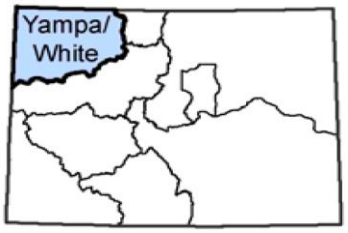
Southwest Goals and Measurable Outcomes:
In order to address this municipal gap, the Southwest Draft BIP has four goals related to meeting municipal and industrial needs. These goals and the associated measurable outcomes are below [8]:

- Pursue a high success rate for identified specific and unique projects and processes to meet municipal gap and to address all water needs and values.
    - Complete 41 IPPs aimed at meeting municipal water needs.
- Provide safe drinking water to Colorado's citizens and visitors.
    - Consistently meet 100% of residential, commercial and industrial water system demands identified in SWSI 2010 in each sub-basin, while also encouraging education and conservation to reduce demand.
    - Implement at least 1* IPP that protect or enhance the ability of public water supply systems to access and deliver safe drinking water that meets all health- based standards.
- Promote wise and efficient water use through implementation of municipal conservation strategies to reduce overall future water needs.
    - Change the ratio of in-house to outside treated water use for municipal and domestic water systems (referred to as water providers herein) from the current ratio of 50% in-house use and 50% outside use, to 60% in-house use and 40% outside use (60/40 ratio) for Southwest Colorado and the entire State by 2030.
    - The water providers in the state that are using dry up of agricultural land (defined as requiring a water court change case) and/or pursuing a new Trans Mountain Diversion (TMD) (as defined by IBCC to be a new west slope to east slope diversion project) shall have a higher standard of conservation. The goal for these water providers is a 70/30 ratio by 2030. This is a prerequisite for the Roundtable to consider support of a new TMD.
- Support and implement water reuse strategies.
    - Implement 3 informational events about water reuse efforts, tools and strategies.

Meeting the Southwest's Municipal and Industrial Gaps
The Southwest Draft BIP developed a list of potential municipal and industrial projects by interviewing providers in each sub-basin [9]. The Southwest Draft BIP identified 37 projects that would meet future municipal supply needs, and several others that would address other infrastructure needs within the basin. Of these projects, seven quantified acre-feet, totaling nearly 32,000 acre-feet. However, it is not clear if each geographic region identified in the Draft BIP will be able to meet its future needs if the listed projects are implemented [9].

Although these specific projects do not necessarily provide water to the areas of need, once acre-feet are quantified for the other projects, municipal gaps will likely be met, if the projects are

implemented. Until such a time as there is more specificity, the Southwest Basin will be considered to have partially met its future municipal and industrial needs with its Draft BIP.



Yampa / White / Green

The Yampa / White / Green Basin faces a gap that could begin as early as 2015 in Rio Blanco and Moffat Counties [11]. Future needs in this northwest Colorado region are likely to increase by 34,000 to 95,000 acre-feet according to SWSI 2010. However, these needs likely need to be revised downward since all indications are that oil shale will not become commercially viable by 2050 [10]. With existing data, currently planned projects leave a municipal water supply gap within Colorado's northwest region of 24,000 to 83,000 acre-feet. This assumes that identified projects and processes are implemented at a relatively high success rate [2].

Yampa/White/Green Goals and Measurable Outcomes:

To address this municipal and industrial gap, the Yampa/White/Green Draft BIP identified four goals related to meeting municipal and industrial needs. These goals and relevant measurable outcomes and processes are below [8]:

- Protect and encourage agricultural uses of water in the Yampa-White-Green Basin within the context of private property rights.
    - Encourage and support M&I projects that have components that preserve agricultural water uses (process).
- Identify and address M&I water shortages.
    - Reliably meet 100% of municipal and industrial demands in the basin through the year 2050 and beyond through the following processes:
        - Identify specific locations in the Basin where municipal and industrial shortages may exist in drought scenarios, quantify the shortages in time, frequency, and duration.
        - Identify impacts throughout the Basin in the context of water shortages (drought and climate change), wildfire and compact shortage on municipal and industrial demands.
        - Identify projects and processes that can be used to meet M&I needs.
        - Encourage collaborative multi-use storage projects.
        - Support efforts of water providers to secure redundant supplies in the face of potential watershed impacts from wildfire.
        - Encourage municipal entities to meet some future municipal water needs through water conservation and efficiency.

Meeting the Yampa/White/Green's Municipal and Industrial Gaps

The Yampa / White / Green Draft BIP conducted the most thorough analysis of how well implementation of future projects and methods would meet municipal and industrial needs. In addition, the Draft BIP assessed these needs under a hot and dry future. Below is an excerpt from the Draft BIP describing future shortage potentials:

Municipal Shortages:
M&I demands are small compared to agricultural demands in the YWG Basin…. Under Baseline Conditions, no shortages exist to M&I demand nodes due to generally adequate water supply and augmentation from reservoirs.

While M&I shortages exist under the high demand, low water supply scenarios of the Dry Future IPP Scenario and the Dry Future Scenario, the shortages remain below 10%. Under both scenarios, District 43 Existing M&I in Rio Blanco County (Rangely Water, Meeker Demand) and District 58 Existing M&I in Routt County (the City of Steamboat Springs) begin to exhibit shortages, whereas Moffat County municipal nodes do not show M&I shortages under either scenario. If IPPs are developed that include M&I use, shortages would likely decrease in locations with supply augmentation.

Industrial Shortages
Under Baseline Conditions, no shortages exist for Self-Supplied Industrial (SSI), which consist of thermoelectric power generation needs. Slight shortages exist for the Hayden Station and units 1 and 2 of Craig Station under the Dry Future IPP Scenario and the Dry Future Scenario. These scenarios meet thermoelectric demands with redundant water supplies from Steamboat Lake for Hayden Station and Elkhead and Stagecoach Reservoirs for Craig Station. The shortages occurred for both locations in a dry month in March 1961 but become nearly negligible (0.14% for Hayden Station and 0.12% for units 1 and 2 at Craig Station for both scenarios) when averaged over the 56-year period of record used in the P&M Study.

However, SSI water users consider their water supply short when they must rely upon redundant water supplies. For example, the years 2002, 2003, 2012 and 2013 were considered water supply short or borderline short by some SSI water users due to reliance on redundant supplies. Further discussions will take place on the most appropriate Baseline Conditions and the assessment of shortages in light of drought, climate change and evolving power generation technologies [10].

Figure 6.2-1 from the Draft BIP demonstrates these shortages for all sectors in a dry future with projects and methods implemented.

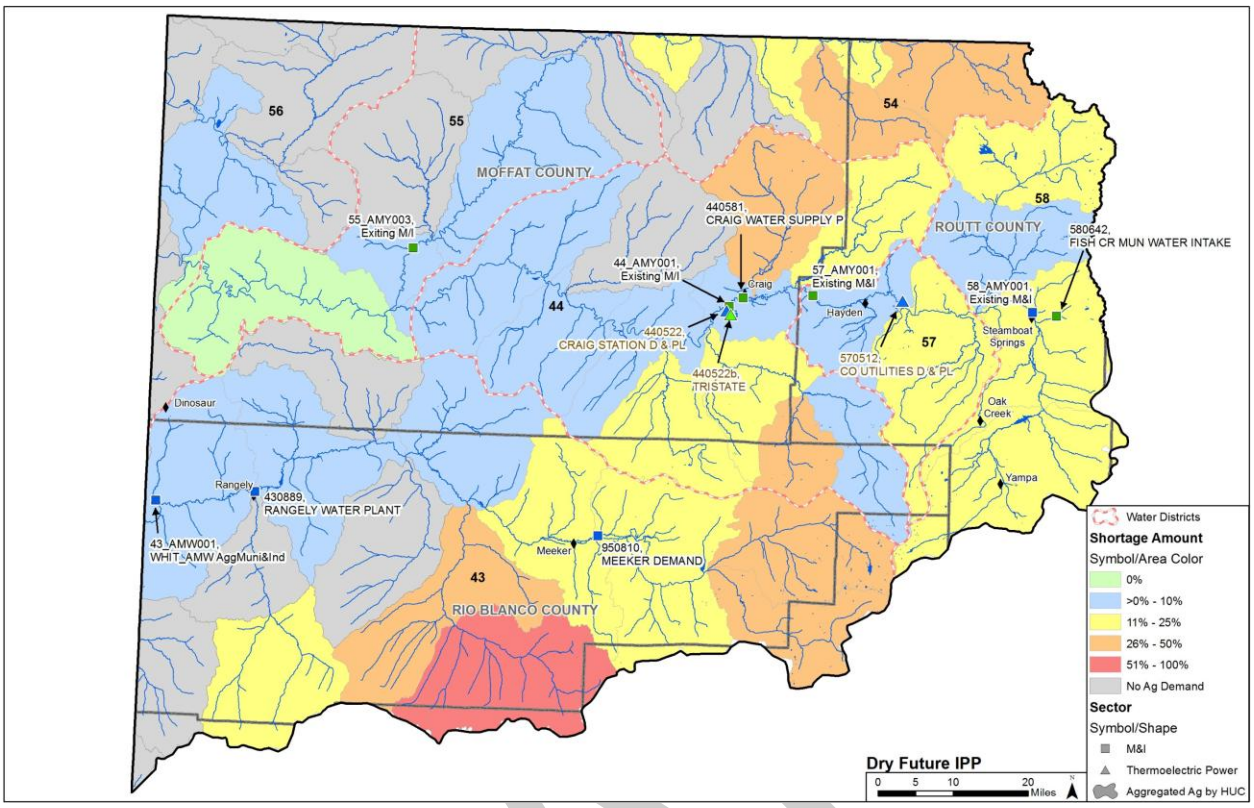


Figure 6.2-1 Municipal, industrial, and agricultural shortages in a dry future with identified projects and processes implemented

Overall, the Draft BIP modeled six projects and methods, including conservation in Steamboat Springs, which were not previously identified in SWSI 2010. Only projects that identified a project proponent, a location, physical characteristics, and operations were modeled. Most of the acre-feet quantified are associated with meeting the potential needs of the energy industry. The total newly quantified acre-feet adds up to 211,000 acre-feet to meet municipal and industrial needs [10]. Although the total acre-feet identified exceeds the M&I gap, when modeled, some shortages of up to 10% exist for several communities and a few power plants. The Basin Roundtable plans to complete the Draft BIP by identifying "opportunities for additional multiuse projects," adding them to the model, and then reassessing the results [10]. In conclusion, the Draft BIP identified projects that mostly meet future municipal and industrial demands in Rangely, Meeker, and Steamboat Springs, and fully meet future demands in Craig.

6.2.4 Meet Colorado's Agricultural Needs

The agricultural gap is defined as the difference between what a basin indicates it wants to achieve with regard to agriculture, as defined in its goals and measurable outcomes, and what projects and methods it has determined could be implemented to meet those needs [12]. While every basin indicated that maintaining viable agriculture is one of the most important aspects of its Draft BIP, this definition allows for considerable variability between basins, which face different issues related to agriculture.

Colorado's irrigated acres are expected to decline in almost every basin by 2050 (Figure 6.2-2), but these projected declines have different causes. Similarly, every basin has agricultural shortages. The Draft BIPs work to address these challenges by identifying projects that could reduce shortages, maintain the agricultural economy, and in some cases increase irrigated acres.

To address the challenges of shortages and declining irrigated acres, CWCB identified three statewide long-term goals [1]:

- Ensure Agriculture Remains a Viable Economic Driver in Colorado, Supporting Food Security, Jobs, and Rural Communities While Maintaining and Protecting Private Property Rights
- Meet Colorado's Agricultural Demands
- Implement Efficiency and Conservation Measures to Maximize Beneficial Use and Production

Prior to exploring how the Draft BIPs developed solutions to meet these and other local goals, it is important to understand some of the statewide issues related to shortages and a decline in irrigated acres. Irrigated acres are expected to decline for three primary reasons [13]:

1. Urbanization of agricultural lands, which is primarily an issue in the South Platte and Colorado Basins;
2. Conversion of agricultural water rights to municipal rights to meet future municipal needs, which is mostly occurring in the South Platte, Colorado, and Arkansas Basins; and
3. Voluntary reductions in water use associated with sustainable groundwater supplies and meeting compact obligations, which is ongoing in the Rio Grande and Republican Basins.

Underlying many of the reasons for agricultural decline are temporary and downward state, national, and international agricultural economic trends. However, by 2050 the agricultural economy is expected to be increasingly viable due to a global increase in the number of people who need food, and also those who can afford high quality and high-protein agricultural products [14]. The importance of Colorado's agricultural production is also vital locally. As described in Chapter 5, in some counties fifty percent of jobs are related to agriculture.

From a statewide perspective, it is important to provide options and incentives that help maintain or even increase Colorado's agricultural economy and productivity in the face of losing irrigated acres. The difference between the status quo, which shows a reduction in irrigated acres in almost every basin (see figure 6.2-2), and the strategic position Colorado and the Basins would like to be in from an agricultural perspective in 2050 is the "agricultural gap." However, quantifying this prospective agricultural gap is difficult, resulting in many basins choosing to reduce agricultural shortages.

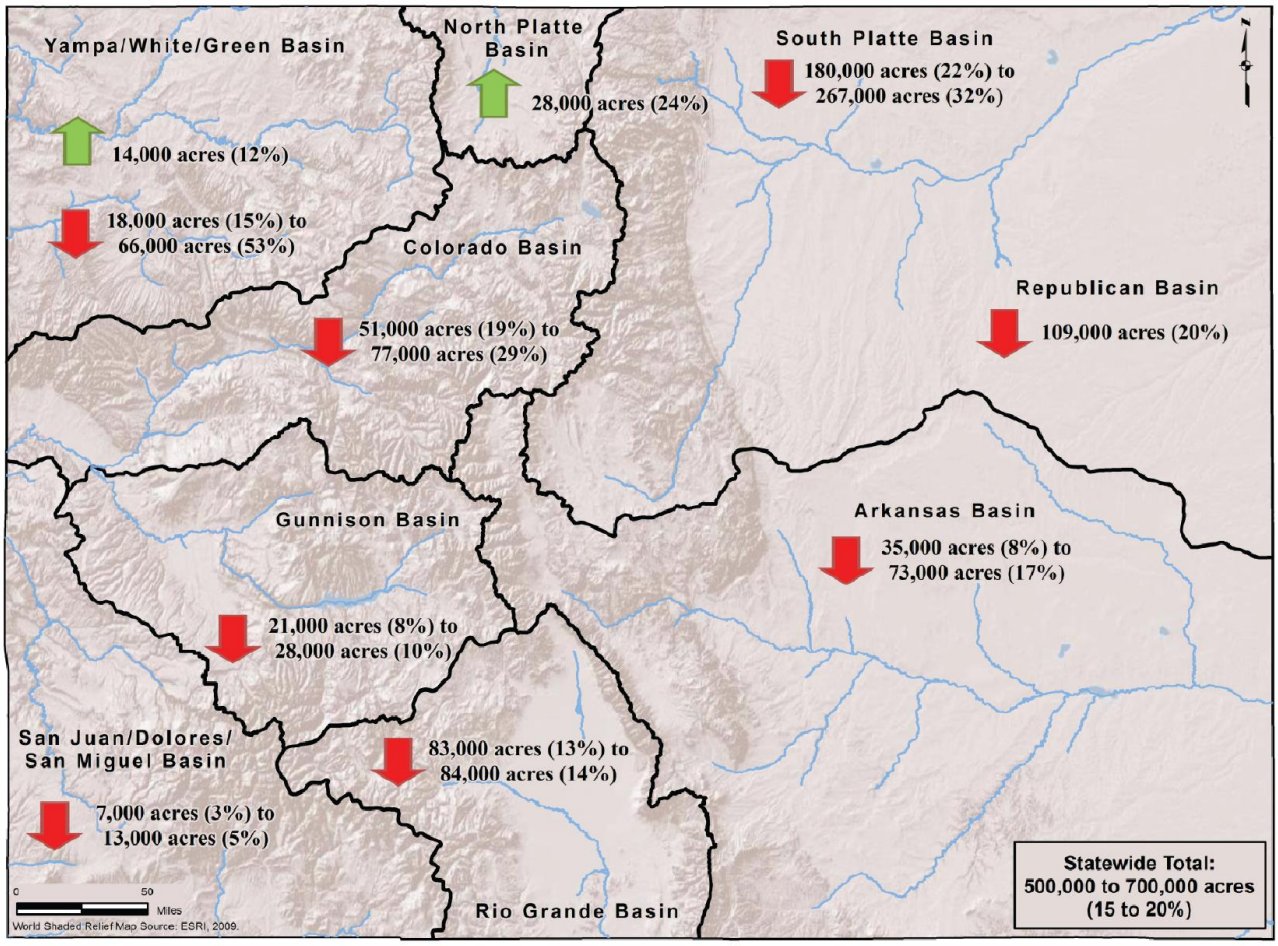


Figure 6.2-2 Potential changes in irrigated acres by 2050 [13] (⬆= increase in irrigated acres; ⬇=decrease in irrigated acres)

Several basins discuss reducing shortages, and it is therefore important to understand how an agricultural shortage is defined. As described in the Gunnison Draft BIP, agricultural shortages can be due to three primary factors [5]:

> **Physical shortages** are due to lack of physical supply. Such shortages are often seen later in the irrigation season principally by irrigators on smaller tributaries. Though irrigation water rights may be in priority, there is not enough supply. Although these shortages are exacerbated in dry years, on many of the tributaries physical flow is not sufficient to meet the CIR [crop irrigation requirement] for the entire growing season even in wet years.
>
> **Legal shortages** are those due to lack of legal supply; there may be physical supply at a headgate, but it must be bypassed to meet downstream senior water rights. This type of shortage is often seen later in the season by irrigators with junior water rights in average and wet years, and may be the situation for junior irrigators the entire growing season in dry years.
>
> **Irrigation Practice "shortages"** result from specific irrigation practices; the irrigator may have physically and legally available supply but chooses not to irrigate. For example, some irrigators may need to reduce or cease irrigation to allow the land time to dry prior to haying or grazing. In addition, an irrigator may cease diverting because there is not enough time

> left in the growing season for an additional cutting. Note, though this [is]a very different type of shortage, it is equally important to document. Identification of shortages related to irrigation practices helps to quantify the difference between CIR and actual consumptive use in SWSI and other statewide planning efforts. In addition, since irrigation practice shortages cannot be addressed by increased water supply, their identification helps to focus on the implementation of projects that meet physical and legal shortages.

Due to economic viability, irrigation practice "shortages," and other factors, an agricultural shortage is not necessarily an agricultural gap. Colorado continues to have a healthy agricultural economy, despite shortages between seventeen and forty-five percent statewide.

This subsection reviews information by basin, and table 6.2-3 summarizes the success of each basin in meeting the agricultural gaps they defined through their goals.

Basin	Irrigated Acres [13]	Shortage (AFY) [13]	Potential New AF	# of New Projects w/ AF Info	Summary of How BIPs Met Their Ag Goals / Gap
Arkansas	428,000	453,000	In process	0	Not sustain ag $1.5B economy w/ actions, but establish tracking; not develop specific augmentation water projects; policies and projects support rotational fallowing, policies to support ag related rec and env. w/ cons easements
Colorado	268,000	100,000	453,000 - 483,000	41	Yes ↓ shortages; no specific efforts to develop incentives or ↓ urbanization and ag to urban transfers
Gunnison	272,000	111,000 [5]	123,000	16	Yes ↓ shortages, partially discourage transfer out of ag w/ policies
Metro/ South Platte	1,381,000 (831,000 SP, 550,000 Republican)	579,000 (379,000 SP, 200,000 Republican)	None ID'd	0	Partially ↓ permanent dry up w/ conceptual ATMs, not ↓ urbanization or shortages
North Platte	117,000	89,000	12,000	12	↑ # of irrigated acres to partially meet 17,000 acre goal; ↑ storage to partially meet 37,000 AF goal
Rio Grande	622,000	428,000	N/A	N/A	Yes, improve infrastructure; partially improve ag economy
Southwest	259,000	198,000	7,600	4	Partially ↓ shortages; Yes, ↑ efficiency w/ 10 IPPs; policy to minimize acres transferred, no ag sharing IPPs
Yampa / White / Green	119,000	54,000	54,000	5	↑ # of irrigated acres to partially meet 15,000 acre goal; partially ↓ shortages by 10%
TOTAL	3,466,000	2,028,000	537,000	61	

Table 6.2-3 Summary of How Each Basin Met Its Agricultural Gaps

Arkansas

The Arkansas Basin has the third most irrigated acres in Colorado and the highest percentage of shortages as a basin (45%) [13]. In addition, irrigated acres are likely to decline by eight to seventeen percent [13]. These declines are primarily due to agricultural transfers from both within the basin and from municipal interests in the South Platte. However, as many as 3,000 (1%) irrigated acres could be urbanized as well.

Arkansas Goals and Measurable Outcomes:

In order to address these pressures, the Arkansas Draft BIP identified four goals related to sustaining agriculture [3]. These goals and the associated measurable outcomes are below:

- Sustain an annual $1.5 Billion agricultural economy in the Basin
  - Increase in measured economic productivity by update of CSU Study in 2020.
- Provide increasing quantities of augmentation water for increased farm efficiencies
  - Document the baseline of current augmentation available.
  - Track available storage facilities for augmentation sources.
- Develop a viable rotating fallow and/or leasing program between agriculture and municipal interests to address drought and provide risk management of agriculture.
  - Report on pilot projects underway as of Dec, 2015.
  - Completion and presentation of report by Dec, 2015.
  - Survey of permanently retired acreage as of Year 2020.
- Sustain recreation and environmental activities that depend on habitat and open space associated with farm and ranch land.
  - Measure the economic contribution of tourism to the basin economy within the CSU 2020 update.
  - Change of status for "protected" attributes as measured by nonconsumptive projects and methods in SWSI 2016 report.

Meeting the Arkansas' Agricultural Gaps

The primary goal is to support the $1.5 billion agricultural economy [3] in the face of agricultural loss. As the Draft BIP indicates, a multi-pronged strategy is necessary:

> To maintain that level of economic productivity, projects and methods described in [the BIP] focus on development of rotating fallowing, conservation easements, and increased storage capacity to allow agricultural water to sustain agricultural productivity. In particular, a three-pronged approach to understanding rotational fallowing within the Prior Appropriation Doctrine is underway – an administrative and accounting tool, pilot projects and public policy dialogue – and will continue" [3].

However, the Arkansas is still in the process of developing specific projects and methods that would address these goals. Therefore, the Arkansas does not yet meet its defined agricultural gap.

Colorado

The Colorado Basin has the fifth most irrigated acres in Colorado and the lowest percentage of shortages as a basin (17%) [13]. In addition, irrigated acres are likely to decline by nineteen to twenty-nine percent [13]. These declines are primarily due to urbanization, accounting for 65-80% of the loss, or 40,000 – 50,000 acres. The remaining agricultural loss is due to agricultural to municipal transfers [13].

Colorado Goals and Measurable Outcomes:

In order to address these pressures, the Colorado Draft BIP identified four goals related to sustaining agriculture [4]. These goals and the associated measurable outcomes are below:

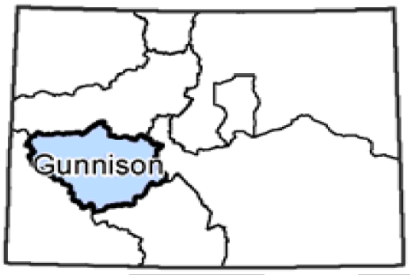
- Reduce agricultural water shortages
    - Identify multi-purpose storage projects and methods that address the annual 100,000 acre-feet agricultural shortage
    - Maintain existing irrigated agricultural acreage
    - Research local agricultural shortage values in the Colorado River Basin
    - Improve Colorado water law to encourage agricultural water efficiency practices without harming water right value
    - Establish lease programs for excess water from existing supply projects in the Municipal and Industrial (M&I) sector or multi-use projects
- Minimize potential for transfer of agricultural water rights to municipal uses
    - Identify farm improvements to develop strong sustainable farm economics
    - Develop a set of quantifiable factors of agriculture pressures that can be measured and evaluated in the future to incentivize production and reduce trends towards transfers
    - Adopt local land use codes to conserve water and reduce pressures for agricultural water transfers
    - Promote conservation easements with the anticipated result that they will be more widely considered by the agricultural community
- Develop incentives to support agricultural production
    - Reimburse agriculture for value added to the environment including, water quality, wildlife, and viewscapes
    - Track effectiveness of agricultural incentives in maintaining irrigated acres
    - Minimize regulatory disincentives such as overly stringent requirements for reservoir construction
    - Reduce taxes for true self-sustaining agriculture
    - Develop incentives that encourage continued agricultural production
- Promote agricultural conservation that maintains agricultural production and viability
    - Revised Colorado Water Law to allow agricultural conservation and improved efficiency measures without impacting water right value or risk of abandonment

- Strive towards a high level of conservation and efficiency within the agricultural industry

Meeting the Colorado's Agricultural Gaps

The Colorado Draft BIP identified 41 projects with quantifications of acre-feet information that could reduce agricultural shortages in the basin by a total of 453,000 to 483,000 acre-feet. These projects could also meet municipal and industrial demands. These projects, if implemented, could eliminate the 100,000 acre-feet of shortages in the basin. However, neither a spatial nor hydrological analysis has been done to confirm this. Furthermore, it is not clear how many of these projects are likely to be implemented as several do not have active project proponents. With regard to addressing agricultural losses due to urbanization, the Draft BIP has several suggestions concerning land use. These could have an effect on reducing urbanization, but that effect has not been quantified in the Draft BIP. In addition, the Draft BIP states a need to promote other activities to minimize agricultural loss due to water rights transfers, improve agricultural efficiency, and support agricultural production. More detail is likely needed to make these policies implementable.

In summary, the Draft BIP most likely fully addresses. the basin's agricultural shortages and partially addresses the other listed goals.



Gunnison

The Gunnison Basin has the fourth most irrigated acres in Colorado and the second lowest percentage of shortages as a basin (20%) [13]. In addition, irrigated acres are likely to decline by eight to ten percent [13]. These declines are primarily due to urbanization, which could take 20,000 to 26,000 acres out of the production [13].

Gunnison Goals and Measurable Outcomes:

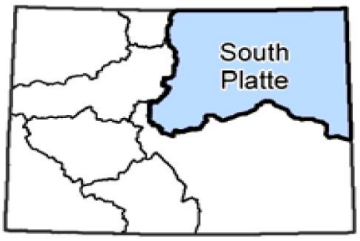
In order to address these issues, the Gunnison Draft BIP identified two goals related to sustaining agriculture [5]. These goals and the associated measurable outcomes are below:

- Improve agricultural water supplies to reduce shortages
  - Reduce basin-wide agricultural shortages by developing 10 projects from the list of recommended solutions in the GBIP by the year 2030
  - Implement the Inventory of Irrigation Infrastructure Improvement Needs projects from the list of recommended solutions in the GBIP by 2020
- Discourage the conversion of productive agricultural land to all other uses within the context of private property rights.
  - Preserve the current baseline of 50,000 protected acres and expand by five percent by 2030

Meeting the Gunnison's Agricultural Gaps

The Gunnison Basin Roundtable identified sixteen projects that it expects to be implemented in the near-term, which if implemented would reduce shortages in the basin. In addition, there are

infrastructure improvement projects which may not yield acre-feet, but will improve agricultural efficiencies. The Gunnison Draft BIP also states a goal of protecting more irrigated acres. Currently, out of the 272,000 irrigated acres in the basin, 50,000 are protected through conservation easements and other heritage protection efforts. The Gunnison Basin Roundtable would like to see another 2,500 acres protected by 2030, and it is not clear if policies within the Draft BIP will enable this to happen. Therefore, the Draft BIP is considered to partially meet the second goal.



Metro / South Platte / Republican

The South Platte and Republican River Basins have the most irrigated acres in Colorado and the percentage of shortages in the region as a whole is 25 percent [13]. In addition, irrigated acres are likely to decline by 22 to 32 percent in the South Platte and by 20 percent in the Republican according to SWSI 2010 [13]. The South Platte Draft BIP reexamined potential loss of irrigated lands in the South Platte based on past trends, and indicated a range of 17 to 21 percent for the South Platte [6]. In the South Platte, these declines are primarily due to agricultural to municipal transfers, but urbanization is expected to account for six to seven percent of the loss, equivalent to 47,000 to 61,000 acres [13]. In the Republican, the loss of over 100,000 irrigated acres is related to factors associated with sustainable groundwater and compact related issues.

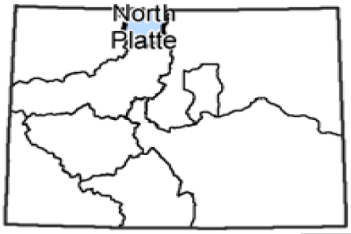
South Platte Goals and Measurable Outcomes:

In order to address these issues, the South Platte Draft BIP identified one goal related to sustaining agriculture [5]. This goal and the associated measurable outcomes are below:

- Fully recognize the importance of agriculture to Colorado's future well-being, and support continued success and develop new voluntary measures to sustain irrigated agriculture.
    - Support strategies that reduce traditional permanent dry-up of irrigated acreage through implementation of other solutions including conservation, reuse, successful implementation of local IPPs, successful implementation of ATMs, and development of new Colorado River supplies.
    - Support strategies by municipalities and other local and state land use authorities that reduce urbanization on irrigated acreage.
    - Support strategies to address agricultural water shortages through IPPs, new multi-purpose projects and innovative measures to maximize use of available water supplies.
    - Develop local tools and political/community support for tools to sustain irrigated farmland.
    - Encourage maintenance of existing wetlands in focus areas associated with agricultural lands.
    - Ensure agricultural dry-up and alternatives take into consideration environmental and recreational focus areas and attributes.

Meeting the South Platte's Agricultural Gaps

The Draft BIP discusses several strategies to reduce agricultural shortages and minimize permanent agricultural losses. Conceptually, the Draft BIP indicates that 30,000 acre-feet of future municipal demands could be met through alternative transfer methods. However, the Draft BIP also lists several barriers to accomplishing ATMs, which need to be overcome to accomplish this. In addition, the Draft BIP discusses the need to preserve the option for developing additional transmountain diversion water, which would lessen the need for significantly more agricultural transfers to occur. There are no IPPs identified that explicitly address agricultural shortages. The Draft BIP indicates the Basin Roundtable would like to further investigate options surrounding land use, which could increase urban densities, and therefore reduce the number of agricultural acres that are urbanized. The Draft BIP does not go into depth with regard to developing local political tools or ensuring that environmental and recreational values associated with agriculture are taken into account. Therefore, the Draft BIP is considered to partially meet its goals and measurable outcomes.



North Platte

To address these issues, the North Platte Draft BIP identified two goals related to sustaining agriculture [7]. These goals and the associated measurable outcomes are below:

North Platte Goals and Measurable Outcomes:

In order to address these issues, the North Platte Draft BIP has two goals related to sustaining agriculture [7]. These, along with the associated measurable outcomes are below:

- Maintain and maximize the consumptive use of water permitted in the Equitable Apportionment Decree and the baseline depletion allowance of the Three State Agreement.
    - Develop three projects from the list of recommended solutions by 2020.
    - Incrementally bring up to 17,000 additional acres under irrigation by 2050.
    - Develop 37,000 acre-feet of additional storage (doubling of current storage) by 2050.
- Continue to restore, maintain, and modernize critical water infrastructure to preserve current uses and increase efficiencies.
    - Develop three projects from the list of recommended solutions by 2020.

Meeting the North Platte's Agricultural Gaps

The North Platte identified twelve projects with acre-feet, acreage, or cubic feet per second estimates. Six of the projects have water volume information, and half of these do not identify the associated increase in acreage that they would provide. It is estimated that approximately 12,000 acre-feet could be generated from these projects. Similarly, nine potential projects include information on the acreage that could be served, but six descriptions do not include how many acre-feet are associated with the projects. All in all, over 12,000 acres were identified in the Draft BIP. It is assumed that the three projects without associated acreage would add to this number, but given the available data, approximately seventy percent of the North Platte Draft BIPs goal to

increase acreage is met. Additionally, there are several listed projects that work to restore, maintain, and modernize water infrastructure in the basin. However, the goal to increase storage by 37,000 acre-feet is only partially met by the Draft BIP.

Rio Grande

The Rio Grande Basin has the second most irrigated acres in Colorado and the basin as a whole using 67 percent of its crop irrigation water requirement [13]. In addition, irrigated acres are likely to decline by thirteen to fourteen percent, or over 80,000 acres [13]. These declines are primarily due to groundwater sustainability issues that are being addressed by the formation of groundwater subdistricts [8]. The purpose of the subdistricting is to:

> The overall objective of this Plan is to provide a water management alternative to state-imposed regulations that limits the use of irrigation wells within the Subdistrict, that is, a system of self-regulation using economic-based incentives that promote responsible irrigation water use and management and insure the protection of senior surface water rights [15].

Rio Grande Goals and Measurable Outcomes:

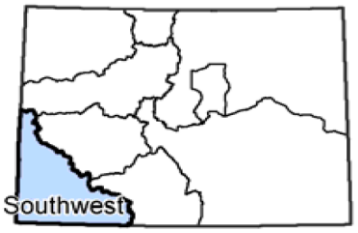
To address these issues, the Rio Grande Draft BIP identified two goals related to sustaining agriculture [8]. These goals and the relevant measurable outcomes are below:

- Operate, maintain, rehabilitate and create necessary infrastructure to meet the Basin's long-term water needs, including storage.
    - A database of existing water infrastructure including documentation of infrastructure condition and mapping of all storage reservoirs and major ditch diversions is created.
    - Reservoirs operate at full design capacity without restrictions.
    - Diversion structures and conveyance systems function optimally.
- Management water use to sustain optimal agricultural economy throughout the Basin's communities.
    - The cultural heritage of agricultural water use in the San Luis Valley is recognized.
    - Agriculturally supported jobs are sustained.
    - Rangeland is maintained and improved.
    - Soil health is enhanced and soil loss is minimized on both farmland and rangeland.
    - Alternative agriculture practices that improve soil health and/or reduce consumptive use without impacting crop yields are supported and implemented to the extent practicable.

Meeting the Rio Grande's Agricultural Gaps

The Rio Grande is not seeking to reduce shortages or increase irrigated acreage. Instead, it seeks to better manage its agricultural water resources and economy in the face of needing to reduce irrigated acreage. Consequently, most of the fifteen agricultural related projects analyzed in the Draft Rio Grande Draft BIP do not have new acre-feet associated with them. Instead, six of the Draft

BIP's projects focus on monitoring, assessment, and planning. The storage improvement and expansion projects are largely focused on improved augmentation and administration opportunities that would help meet irrigation as well as environmental and recreational needs. The Rio Grande Basin Roundtable plans to continue to develop detail for additional projects and methods for its final BIP. In summary, the Rio Grande's draft plan partially meets its defined agricultural gap, and this will be reassessed once additional projects and methods are analyzed.



Southwest

The basins in the Southwest have the sixth most irrigated acres in Colorado and the third highest percentage of shortages as a basin (34%) [13]. In addition, irrigated acres are likely to decline by three to five percent [13]. These declines are primarily due to urbanization, although if Colorado River supplies are not available, some agricultural to urban transfers may be necessary [13].

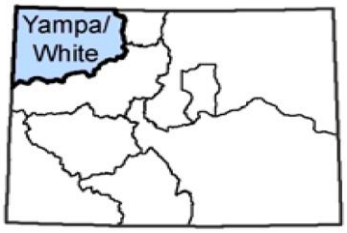
Southwest Goals and Measurable Outcomes:

To address these issues, the Southwest Draft BIP identified three goals related to sustaining agriculture [9]. These goals and the associated measurable outcomes are below:

- Minimize statewide and basin-wide acres transferred.
    - Implement projects (e.g. ATMs, efficiency, etc.) in order to help preserve agriculture and open space values, and to help address municipal, environmental, recreational, and industrial needs; while respecting private property rights.
    - Implement strategies that encourage continued agricultural use and discourage permanent dry-up of agricultural lands.
    - The water providers in the state that are using dry- up of agricultural land (defined as requiring a water court change case) and/or pursuing a new TMD (as defined by IBCC to be a new west slope to east slope diversion project) shall have a higher standard of conservation. The goal for these water providers is a ratio of 70% use occurs in-house while 30% use occurs outside (70/30 ratio).
- Implement efficiency measures to maximize beneficial use and production.
    - Implement at least 10* agricultural water efficiency projects identified as IPPs (by sub-basin).
- Implement IPPs that work towards meeting agricultural water supply shortages.

Meeting the Southwest's Agricultural Gaps

The Southwest Draft BIP contains an extensive IPP list that includes ten agricultural water efficiency projects. In addition, it identifies four projects that have new acre-feet associated with them. These could begin to help reduce agricultural water supply shortages, although there is not a measurable outcome associated with reducing shortages. As stated in the Draft BIP, there are no identified projects that support agricultural sharing or implement strategies that discourage permanent dry-up of agricultural lands. Therefore, the Draft BIP partially meets its defined agricultural gaps.



Yampa / White / Green

The Yampa, White, and Green River basins have the second fewest number of irrigated acres in Colorado and the third lowest percentage of shortages as a basin (23%) [13]. In addition, irrigated acres could either increase by twelve percent with adequate investment or decrease by 15 to 53 percent [13]. The potential loss of irrigated acres will be determined by whether oil shale or other energy interests grow into a large commercial industry and need to rely on agricultural transfers to meet their needs. Very few additional declines in irrigated acres are related to urbanization of agricultural lands [13].

Yampa/White/Green Goals and Measurable Outcomes:

To address these issues, the Draft Yampa, White, and Green Draft BIP identified two goals related to sustaining agriculture [9]. These goals and the associated measurable outcomes are below:

- Improve agricultural water supplies to increase irrigated land and reduce shortages.
    - Reduce agricultural shortages basin-wide by 10 percent by the year 2030.
    - Preserve the current baseline of 119,000 irrigated acres and expand by at least 14,805 acres.
- Protect and encourage agricultural uses of water in the Yampa-White-Green Basin within the context of private property rights.
    - Preserve the current baseline of approximately 119,000 protected acres and expand by 12.4% by 2030.
    - Encourage land use policies and community goals that enhance agriculture and agricultural water rights

Meeting the Yampa/White/Green's Agricultural Gaps

Figure 6.2-1 indicates the modeled level of shortages that still exist within the basin after the Draft BIP's planned projects are implemented in a dry future. These projects not only include the agricultural projects, but also potential energy projects and some municipal projects. The planned energy project would meet much of the needs of a full scale oil shale industry, and would therefore decrease the potential number of irrigated acres that would need to be transferred for industrial purposes. However, some of these projects could cause additional shortages in the basin, although shortages are significantly reduced in the Yampa River between Craig and Maybell. This area has some of the most significant agricultural land in the basin. In addition, the identified projects would help develop some of the additional acreage planned for in the Draft BIP. While the document stresses the need for land use policies that support agriculture, no specific policies are identified. All in all, the Draft BIP mostly meets its defined agricultural gaps, and the Basin Roundtable plans to continue to refine this work for the final version.

6.2.5 Meet Colorado's Environmental and Recreational Needs

The environmental and recreational gap is defined as the difference between what the basin indicates it wants to achieve with regard to meeting its environmental and recreational needs, as defined in its goals and measurable outcomes, and what projects and methods it has determined could be implemented to meet those needs [12]. While every basin indicated that meeting its environmental and recreational needs is an important aspect of its Draft BIP, this definition allows for considerable variability between basins, which face different issues related to the environment and recreation.

Colorado's environmental and recreational needs can be met through protection or restoration projects and methods. These projects and methods could have flow, habitat, water quality, species connectivity, or non-native species management components. Because of this, the nonconsumptive gap is often measured in stream miles. With support from the CWCB, the Basin Roundtables developed focus area maps that indicated where significant species, recreational areas and other environmental attributes are located in each basin. The CWCB then conducted a study to identify and determine the locations of existing and planned projects that met or could meet some of the environmental and recreational values established by the Basin Roundtables. From this data, areas with no known protections can be identified, versus areas with some type of protection (Figure 6.2-3). This information was mapped and included in the Nonconsumptive Toolbox, and an example in the Southwest is shown in figure 6.2-4.

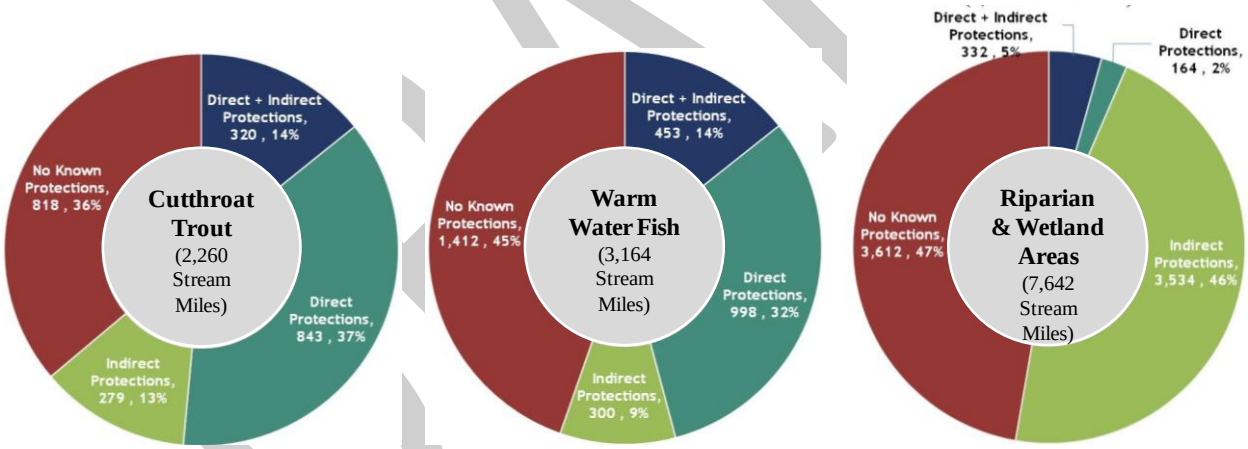


Figure 6.2-3 Percent of stream miles statewide with protection for cutthroat trout species, warm water fish, and important riparian and wetland focus areas.

While not every area that has a project or method may be sufficiently protected, and not every area within the focus areas need protection, these maps provide a good starting point for assessing the locations of potential environmental and recreational gap areas. CWCB is currently working on further refining this methodology and adding in the additional projects and methods identified in the Draft BIPs.

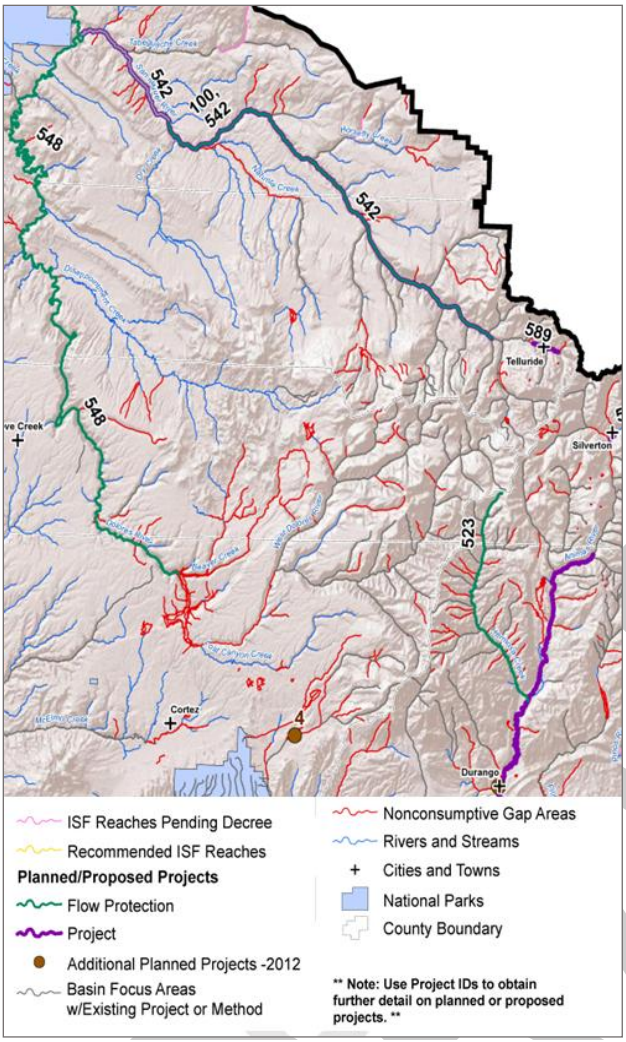


Figure 6.2-4 Southwest example mapping of areas with and without projects offering protection

To address the challenges in meeting the needs of the environment and recreation, the CWCB identified five statewide long-term goals to accomplish this work [1]:

- Promote Restoration, Recovery, and Sustainability of Endangered, Threatened, and Imperiled Aquatic and Riparian Dependent Species and Plant Communities
- Protect and Enhance Economic Values to Local and Statewide Economies Derived from Environmental and Recreational Water Uses, Such as Fishing, Boating, Waterfowl Hunting, Wildlife Watching, Camping, and Hiking
- Support the Development of Multi-Purpose Projects and Methods that Benefit Environmental and Recreational Water Needs as well as Water Needs for Communities or Agriculture
- Protect, Maintain, and Improve Conditions of Streams, Lakes, Wetlands, and Riparian Areas to Promote Self- Sustaining Fisheries and Functional Riparian and Wetland Habitat to Promote Long-Term Sustainability
- Maintain Watershed Health – Protect or Restore Watershed that Could Affect Critical Infrastructure and/or Environmental and Recreational Areas

Each Draft BIP addressed at least four out of five of these long term goals. However, a significant amount of future work needs to occur to better determine how many stream miles the new projects and methods cover and how to strategically address these long term goals.

Table 6.2-4 summarizes the Draft BIP work associated with meeting the Basin Roundtable's environmental and recreational needs, along with perennial[i] stream miles of the environmental and recreational focus areas.

Basin	Focus Area Perennial Stream Miles	No. of Perennial Stream Miles w/ No Known Protections	# of New Projects w/ Stream mile Info	Potential Stream Miles w/ New Projects or Methods	Summary of How BIPs Met Their Environmental and Recreational Goals / Gap
Arkansas	3,124	1,372 (44%)	1	3	The Arkansas is still in progress
Colorado	1,762	844 (48%)	3	32	Partially through support of projects & methods; not identify new funding source or how establish regional cooperatives
Gunnison	1,106	270 (24%)	0	None ID'd	Yes, ID'd 10 projects to be implemented, support Cutthroat Trout Conservation Strategy; ID'd 5 multi-purpose projects; explored some alternative funding sources
Metro/ South Platte	959	325 (34%)	2	2.5	The Metro/South Platte Basin Roundtables are still in progress
North Platte	954	231 (24%)	0	None ID'd	Mostly, ID's more than 3 env. and 2 multi-purpose projects to be implemented, likely increases fishing, waterfowl hunting & viewing by 5% if implemented
Rio Grande	2,735	397 (15%)	1	5	Partially through project implementation, but quantification of how meet goals and measurable outcomes not performed until final
Southwest	2,433	1,009 (41%)	6	183	Unclear until measurable outcomes are revised. 93% on the Lower Dolores for riparian restoration
Yampa / White / Green	485	155 (32%)	0	None ID'd	Mostly, quantifies and determines a number of projects that would support the current PBO on the Yampa, new PBO on the White, warm water fish, riparian areas, and recreational boating; integrates consumptive and env. and rec. interests
TOTAL	**13,557**	**4,602 (34%)**	**13**	**125.5**	

Table 6.2-4 Summary of f How Each Basin Meets Its Environmental and Recreational Gaps.
NOTE: The % of streams with no known protections do not represents gaps for specific species or plant communities, which may be larger.

Arkansas

In the 2011 needs assessment, the Arkansas Basin Roundtable identified 342 perennial stream miles with Arkansas darter, 371 with greenback cutthroat trout, and 1,811 of important riparian and wetland areas. Very few of the perennial stream miles with Arkansas darter are protected. However, two-thirds of greenback cutthroat trout stream miles have some level of protection, whether direct or indirect. Approximately one-third of riparian and wetland areas identified by the Basin Roundtable have some level of protection, and most of those are indirect protections. In addition, 57 percent of the identified fishing areas and 22 percent of the identified waterfowl hunting and view areas have some level of protection.

Arkansas' Environmental and Recreational Goals:

To address their environmental and recreational needs, the Arkansas Draft BIP established seven goals [3]:

- Preclude federal endangered listing of native fish
- Restore state imperiled fish species populations
- Maintain, improve and increase recreational fishing opportunities
- Maintain and restore riparian habitats
- Maintain important avian areas associated with water
- Maintain and restore wetlands
- Maintain, improve, and increase flat water recreation

Meeting the Arkansas' Environmental and Recreational Gaps

The Draft BIP indicates the environmental and recreational components of the plan are incomplete. This work will be completed by finalization of the Draft BIPs, and an assessment as to whether the Draft BIP meets their environmental and recreational gaps will be assessed at that junction point in time.

Colorado

In the 2011 needs assessment, the Colorado Basin Roundtable identified 676 perennial stream miles with Colorado River cutthroat trout, and 435 with imperiled warm water fish, including the endangered fish species. In addition, they identified 1,098 perennial stream miles of important riparian and wetland areas. A full two-thirds of the warm water fish species stream miles have some level of protection, with much of it direct protection. Three-quarters of Colorado River cutthroat trout stream miles also have some level of protection. Similarly, approximately three-quarters of riparian and wetland areas identified by the Basin Roundtable have some level of protection; however, the vast majority of these protections are indirect. In addition, over 90 percent of the identified fishing areas have direct protection.

Colorado's Environmental and Recreational Goals:
To address their environmental and recreational needs, the Colorado Draft BIP developed the theme to *protect and restore healthy streams, rivers, lakes and riparian areas* and identified five goals. These goals and the associated measurable outcomes, are listed below [4]:

- Protect and rehabilitate healthy rivers, streams, lakes and riparian areas
    - A map depicting high priority reaches that have insufficient or poorly timed flows (e.g., 15-Mile Reach, 303(d) impaired streams, instream flows, monitoring and evaluation reaches, ecological impacted, recreational significant, reaches with existing dams
    - Map or list of reaches where habitat has deteriorated as a result of non-flow related changes and could be restored
    - Improve habitat conditions in all identified prioritized reaches in exchange for harm caused by existing or additional water development
    - Reduce the number of river miles where non-native invasive fish and invasive riparian species have degraded aquatic and riparian communities
    - Identify reaches where additional flows can restore degraded rivers
- Define water quality needs and at-risk water bodies (further described in section 7.3 on water quality)
- Preserve high quality recreational river and stream reaches with appropriate flows
    - Maintain number of boater days on 28 reaches identified as recreation priorities by American Whitewater in cooperation with the WFET work
    - Protect access and flows levels to 28 popular recreational reaches
    - Develop more Recreational in-Channel Diversions (RICDs) structures and water rights on community and basin supported reaches to protect recreational flows
- Develop a basin-wide funding system to meet basin environmental and recreational needs
    - Establish a new funding agency or existing agency for the basin or in every county in the basin to fund environmental and recreational management
    - Leverage existing financial resources to further protect or restore all streams, rivers and lakes that host prioritized recreational or natural attributes (determine source and scope of funding)
    - Fund the acquisition of conservation easements that retain agricultural purposes and current uses of water
- Expand regional cooperation efforts to improve efficiency, provide water supply flexibility, and enhance environmental and recreational amenities
    - Established regional water provider, ditch company and environmental & recreational advocate cooperatives focused on improving regional relationships, water supply redundancy and flexibility, water quality, coordinated efforts for multi-beneficial projects and addressing environmental and recreational needs
    - Increase permanent interconnects between water providers where feasible

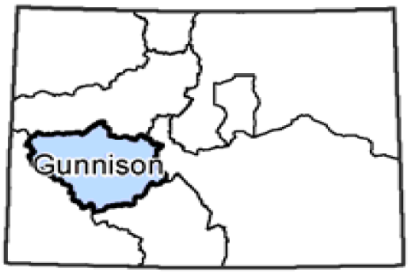
Meeting the Colorado's Environmental and Recreational Gaps
The Draft BIP identified fifty nine projects that are explicitly environmental and recreational projects. In addition another thirteen address recreational needs and an additional thirteen that

address water quality. Many of these are associated with the Colorado River Cooperative Agreement and the Windy Gap Firming Intergovernmental Agreement. Of these approximately two thirds are new projects and methods.

The Draft BIP recognizes that in order to better determine how to move forward with necessary projects and strategically meet the identified needs that a basin-wide stream management plan is needed, and the Draft BIP indicates that it is a top priority. The Draft BIP states, "From this effort projects could be identified, funded and completed across the Basin, between watersheds and across county lines to make lasting impacts to our streams, riparian areas and overall ecosystem. A project champion needs to be determined as well as funding sources and identified metrics" [4].

The Draft BIP further contends that that "all basins statewide must have a number one priority of protecting and improving the health of our rivers and streams" [4].

At this point in time, it is not clear if the dozens of projects identified would adequately address the environmental and recreational goals and measurable objectives identified, but these projects would at least partially meet the Draft BIPs objectives and a streamflow management plan, if implemented, would likely meet all of the objectives. One of the outstanding issues identified by the Draft BIP is the development of a new funding source within the basin.



Gunnison

In the 2011 needs assessment, the Gunnison Basin Roundtable identified 142 perennial stream miles with warm water fish species, including federally listed species. Of these, more than 80 percent have some level of protection, and most of these stream miles have one or more forms of direct protection. All of the identified 173 perennial stream miles with Colorado River cutthroat trout have some level of protection, with approximately two-thirds of these miles including direct protection. Nearly 90 percent of the 800 miles of identified perennial stream miles with important riparian and wetland areas have some level of protection as well. However, nearly all of these methods of protection are indirect.

Gunnison's Environmental and Recreational Goals:

To address its environmental and recreational needs, the Gunnison Draft BIP identified two goals, which are listed below, along with the associated measurable outcomes [5]:

- Quantify and protect nonconsumptive water uses.
    - Meet identified environmental and recreational needs basin-wide by developing 10 projects from the list of recommended solutions in the GBIP by the year 2030
    - Implement the Environmental and Recreational Project Identification and Inventory projects from the list of recommended solutions in the GBIP by 2020
    - Improve the current baseline of native trout and endangered fish populations in the Gunnison Basin through the year 2050
- Describe and encourage the beneficial relationship between agricultural and environmental recreational water uses

- Complete at least five new multi-purpose water projects, including two storage projects, in the Gunnison Basin by 2025 that meet multiple needs as identified in this report and other studies
- Explore and develop recommendations on alternative sources of funding from recreational users within the Basin to support development of those multi-purpose water projects

Meeting the Gunnison's Environmental and Recreational Gaps

The Draft BIP reexamined their environmental and recreational needs, and added 8 focus segments. Within those segments, the Draft BIP explored how well existing programs to support the Colordao River Recovery Program for endangered fish species, Cutthroat Trout and the three imperiled warm water fish species, the Bluehead Sucker, Flannelmouth Sucker, and Roundtail Chub.

The Draft BIP indicated that it support the ongoing recovery program and the reoperation of the Aspinal Unit to meet environmental flows for these species. This reoperation was first tried in 2014, and will continue to be monitored and adapt to the needs of the endangered fish species. The Draft BIP highlights that nonnative fish species are the most significant cause for concern in the Gunnison and recommends "***that Colorado explore a must-kill policy for nonnative fish control***. "

The Draft BIP indicated that the ongoing work associated with the Colorado River Cutthroat Trout Conservation Strategy adopted by Colorado, Utah, and Wyoming, was likely sufficient to meet cutthroat trout habitat needs.

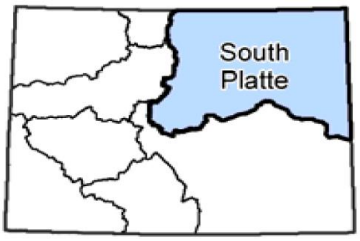
There is an interstate Three Species Agreement in place to protect the three warm water fish species, and Colorado Parks and Wildlife is in the process of developing a State Strategy. As part of this work, "it is imperative that fishery managers work with water managers to continue to implement the actions articulated in the Three Species Agreement. In the Gunnison, flow protection provided by downstream senior water rights (e.g., the Redlands Water and Power Company water rights) become an important means of maintaining the native fishery" [5].

In addition to these ongoing efforts, the Draft BIP identified several additional efforts. Out of the 38 projects and methods assigned to tier 1, which are planned to be completed by 2020, 14 have nonconsumptive components that meet one or more of the Draft BIPs identified environmental and recreational goals. The Draft BIP also identified seventeen important ongoing environmental and recreational protection and monitoring porojects that meet one or more of the goals. Included in the tier 1 projects are a number of studies that would further develop additional nonconsumptive projects to meet each regions need. The Draft BIP identified several types of projects that could be impolemented while preserving existing agricultural uses. These include [5]:

- Diversion infrastructure improvements that increase accuracy and reduce maintenance costs while preserving stream connectivity
- Temporary and voluntary instream flow leasing arrangements that sustain flows during critical drought periods
- Voluntary partial instream flow donations that maintain historical irrigation practices on a more limited basis

- Multipurpose storage projects that include operational flow agreements and/or dedicated environmental and recreational flow components

In summary, if the Draft BIP is fully implemented, then the goals and measurable outcomes would be fully satisfied, and the Gunnison Basin would meet its environmental and recreational gaps.



Metro / South Platte / Republican

In the 2011 needs assessment, the South Platte and Metro Roundtables identified 628 perennial stream miles with warm imperiled plains fish species. Of these miles, more than approximately two-thirds have some level of protection. 90 percent of the identified 79 perennial stream miles with greenback cutthroat trout have some level of protection, although more than half of this protection is indirect. Approximately half of the 628 miles of identified perennial stream miles with important riparian and wetland areas have some level of protection as well, with most of it direct. In addition, approximately half of the important fishing areas identified and one-third of the waterfowl hunting and viewing stream miles have some level of protection.

South Platte's Environmental and Recreational Goals:
To address its environmental and recreational needs, the South Platte Draft BIP developed a goal, which along with the associated measurable outcomes is listed below [6]:

- Fully recognize the importance of, and support the development of environmental and recreational projects and multipurpose projects that support water availability for ecologically and economically important habitats and focus areas.
    - Promote Restoration, Recovery, and Sustainability of Endangered, Threatened, and Imperiled Aquatic, Riparian and Wetland Dependent Species and Plant Communities:
        i. Maintain or increase the habitat for federally and state listed threatened and endangered species or plant communities.
        ii. Maintain or increase habitats in the nonconsumptive focus areas with imperiled species or plant communities and secure the species in these reaches as much as they can be secured within the existing legal and water management context
        iii. Maintain or increase the wetland, lake or stream habitat used by migratory and breeding birds.
    - Protect and Enhance Economic Values to Local and Statewide Economies Derived from Environmental and Recreational Water Uses, Such as Fishing, Boating, Waterfowl Hunting, Wildlife Watching, Camping, and Hiking
        i. Maintain or increase the surface area, stream miles or public access for recreational opportunities of high economic value.
        ii. Maintain or increase the miles and general appearance of trails and greenways to promote aesthetic values and quality of life.
        iii. Maintain or increase public access to fishing opportunities in lakes and streams.

iv. Maintain or increase the total area for birding, waterfowl hunting and wildlife viewing.
v. Maintain or improve the amount of river miles or flatwater surface acres available to river and flatwater boaters.

- Protect, Maintain, and Improve Conditions of Streams, Lakes, Wetlands, and Riparian Areas to Promote Self-Sustaining Fisheries and Functional Riparian and Wetland Habitat to Promote Long-Term Sustainability
  i. Maintain or increase the number of stream miles or surface area of streams, lakes, wetlands and riparian areas for self-sustaining aquatic species populations, and wetland/riparian habitat.
  ii. Maintain or improve fish habitat by providing habitat enhancements, eliminating dry up points, and promoting connectivity.
  iii. Maintain or improve watershed health through source water protection, wildfire mitigation, sedimentation control and erosion control.
  iv. Encourage existing and develop innovative tools to protect instream flows where appropriate.

Meeting the South Platte's Environmental and Recreational Gaps

Through the Basin Roundtable process, the Draft BIP identified seven additional focus area reaches that were added to the basin needs assessment maps. This work expands the number of areas where a focus on addressing environmental and recreational needs is important. The Draft BIP also assessed dry-up points within the South Platte, identifying fifteen areas that experience no flows during some years at some points in time. These dry up points affect species connectivity and habitat.

In order to determine the types of projects needed to address these environmental and recreational concerns, the Draft BIP assessed the types of projects needed in the following regions:

1. Headwater areas (Upper Mountain area)
2. Metro Corridor
3. Boulder/Fort Collins (Northern Area)
4. Plains (Lower South Platte)

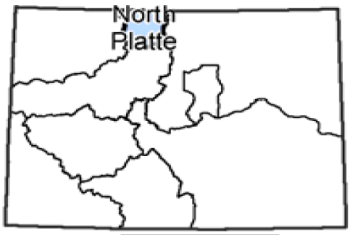
For each of these regions a suite of project types (e.g., instream flows, stewardship projects, species reintroduction, fish passages, modification or improvements to dry-up points or diversion structures that inhibit fish passage, stewardship programs, instream flow programs with water rights components which dedicate historic consumptive use to a downstream user while improving streamflows within a reach of concern) were developed and the number of miles with existing or planned protections was assessed.

In order to move forward with addressing the South Platte's environmental and recreational needs, the Draft BIP has several recommendations throughout the Draft BIP. Some of these include [6]:

- Proactively pursue projects to maintain and enhance the recreational and environmental attributes in the South Platte Basin.

- Ensure that environmental and recreational attributes are protected or potentially enhanced by multi-purpose and collaborative projects through cooperation with M&I and Agricultural users.
- Work to meet the M&I gap, while minimizing the impacts to agricultural uses, and while also providing protections and enhancements to environmental and recreational attributes in candidate focus areas.
- Provide reliable funding sources to assist with environmental and recreational projects, which is essential for projects to move forward. Some of these funding sources include assisting with a portion of the funding needed for multipurpose projects so that environmental and recreational stakeholders can be a partner on such projects.
- Further develop, investigate and document projects and methods and the presence and sufficiency of those projects and methods in enhancing and protecting environmental and recreational attributes.

The South Platte and Metro Basin Roundtables have a grant to continue further developing the environmental and recreational components of their Draft BIP. They plan to address several data gaps and further explore projects that could meet the needs of the basin. The current draft partially meets the environmental and recreational gaps identified through the goals and measurable outcomes process.



North Platte

In the 2011 needs assessment, the North Platte Basin Roundtable identified 222 perennial stream miles with important fishing areas, the Basin Roundtable's top priority. Approximately one-third of these miles have some direct protection, and the remaining stream miles have no known protections. There are 93 miles of perennial streams with waterfowl hunting and viewing, with 45% having some form of direct protection. Over a quarter of the 220 miles of identified perennial stream miles with important riparian and wetland areas have some level of protection as well.

North Platte's Environmental and Recreational Goals:

To address its environmental and recreational needs, the North Platte Draft BIP identified two goals. These goals and the associated measurable outcomes, are below [7]:

- Maintain healthy rivers and wetlands through the strategic implementation of projects that meet prioritized nonconsumptive needs.
    - Increase fishing user days by five percent by 2020.
    - Increase waterfowl hunting and viewing days by five percent by 2020.
    - Develop three projects from the list of recommended solutions by 2020.
- Describe and quantify the nonconsumptive benefits of agricultural use.
    - Complete at least two new multi-purpose water projects in the North Platte Basin by 2025 that meet multiple needs as identified in this report and other studies.

Meeting the North Platte's Environmental and Recreational Gaps

To better determine where the Basin Roundtable should focus its efforts, the Draft BIP developed a weighted attribute map. The map takes into account both the number of attributes and the priority rank given by the Basin Roundtable during the needs assessment process. The Draft BIP states "This map will be used to help target projects to address identified environmental and recreational attributes in the basin, including both multi-purpose projects and specific environmental and recreational projects" [7].

The Draft BIP identified 49 planned environmental and recreational projects, three of which are multi-purpose. Out of the list of potential projects, the Draft BIP developed project summaries for fourteen projects and methods. Of these, five help maintain healthy rivers and wetlands, and four of these projects also demonstrate the connection between agriculture and environmental and recreational values. The Draft BIP describes these projects as follows:

> The projects include reservoir improvements on to preserve a major water supply for the maintenance of habitat at the Arapahoe National Wildlife Refuge, the improvement of a major diversion structure to address fish connectivity while addressing other water user needs, improvement of fisheries habitat at State Wildlife Areas (public access fishing), and two inventory projects that could help identity other multi-purpose project opportunities [7].

All in all, if implemented, the Draft BIP would address the measurable outcomes that together call for five projects that meet nonconsumptive needs. It is not clear if these projects will reach the fishing and waterfowl hunting targets identified by the Draft BIP. However, the Draft BIP mostly meets its identified environmental and recreational gaps.

Rio Grande

In the 2011 needs assessment, the Rio Grande Basin Roundtable identified 564 perennial stream miles with Rio Grande chub, an imperiled fish species. 54 percent of the stream miles have some level of protection, most of which is direct. Another warm water imperiled fish species is the Rio Grande sucker, which is listed as state endangered. Over 60 percent of the 346 perennial stream miles that support this species have some level of protection, though more than half of it is indirect. Nearly 40 percent of the identified 748 perennial stream miles with Rio Grande cutthroat trout have some level of protection, although most of this protection is indirect. Similarly, just over 40 percent of the 2,138 miles of identified perennial stream miles with important riparian and wetland areas have some level of protection, with most of it direct.

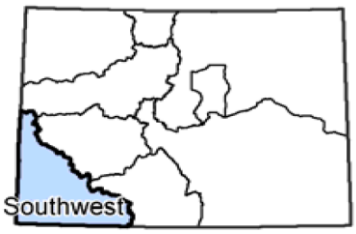
Rio Grande's Environmental and Recreational Goals:

To address its environmental and recreational needs, the Rio Grande Draft BIP identified four goals. These goals and the associated measurable outcomes are below [8]:

- Protect, preserve and enhance terrestrial and aquatic wildlife habitats throughout the Basin.

  - Species that are listed by either the federal or state government as threatened, endangered or candidate species are recovered or de-listed.
  - Additional species are prevented from being listed by the federal or state government.
  - Economic impact studies for environmental and recreational benefits are considered in the decision-making process for new water supply projects.
  - Wildlife habitat needs are considered in the decision-making process.
  - Natural resource agencies in the SLV coordinate and cooperate with each other to comply with the groundwater rules and regulations and augmentation plans to benefit wildlife and recreation to the largest extent possible.
  - Water needs for wildlife habitat are addressed in plans, databases and SLV-wide surveys of appropriate wildlife populations.
- Conserve, restore, and maintain wetlands and riparian areas for the benefit of a healthy watershed.
  - Needs for properly functioning wetlands and riparian areas are identified.
  - Ecological function of wetlands and riparian areas are restored.
  - Projects are developed and implemented to restore, conserve and sustain functioning wetlands, riparian areas and associated habitats with a focus on incorporating connectivity for species.
- Work to establish active river flows throughout the year in cooperation with water users and administrators to restore and sustain ecological function of the rivers and floodplain habitats within the context of existing water rights and compact obligations.
  - Active plans and cooperative agreements are negotiated that enhance streamflows through re-operations while ensuring full compliance with Colorado water law.
- Maintain and enhance water dependent recreational activities.
  - Floatable flow levels are identified by reach.
  - Cooperative water management provides flows to extend recreational opportunities.
  - Recreational facilities are improved and/or added to.
  - Quality and quantity of fishing opportunities are improved. Fish and boat passages are installed where appropriate.
  - Conservation pools are rehabilitated, secured and/or conserved as possible.
  - Quality and quantity of hunting (waterfowl, small game and big game) opportunities are improved.
  - Fish hatcheries have sustainable, secure and adequate physical and legal water supplies.
  - Economic benefits of recreation are recognized in decision-making processes.

Meeting the Rio Grande's Environmental and Recreational Gaps
Out of the eighteen projects analyzed in the Rio Grande Draft BIP, twelve projects help meet the goals identified above. In addition, the Draft BIP will analyze an additional eight projects that address environmental and recreational information gaps, which will further help clarify the environmental and recreational gaps. At this point in time, the Draft BIP partially meets its environmental and recreational gaps.



Southwest

In the 2011 needs assessment, the Southwest Basin Roundtable identified 834 perennial stream miles with imperiled warm water fish species, including the flannelmouth sucker, bluehead sucker, and roundtail chub. Nearly two-thirds of these stream miles have some level of protection, although most of these are indirect. Approximately 70 percent of the identified 178 perennial stream miles with Colorado River cutthroat trout have some level of protection, although most of this protection is also indirect. Just under 60 percent of the 762 miles of identified perennial stream miles with important riparian and wetland areas have some level of protection, with all of it direct. The needs assessment report also identified various forms of recreation, such as fishing and waterfowl hunting and viewing. Very few stream miles have identified protections for these values.

Southwest's Environmental and Recreational Goals:
To address its environmental and recreational needs, the Southwest Draft BIP identified three goals. These goals and the associated measurable outcomes are below [8]:

- Maintain, protect and enhance recreational values and economic values to local and statewide economies derived from recreational water uses, such as fishing, boating, hunting, wildlife watching, camping, and hiking.
    - Implement 10 IPPs to benefit recreational values and the economic value they provide.
    - At least 80% of the areas with recreational opportunities have existing or planned IPPs that secure these opportunities and supporting flows/lake levels within the contemporary legal and water management context. Based on the map of recreational attributes generated for SWSI 2010 80% of each specific value equates to approximately 428 miles of whitewater boating, 185 miles of flat- water boating, 4 miles of Gold medal Trout Streams, 545 miles of other fishing streams and lakes, 3 miles of Audubon Important Bird Area, 143 miles of waterfowl hunting/viewing parcels, and 6 miles of Ducks Unlimited projects.
    - Address recreational data needs.
- Encourage and support restoration, recovery, and sustainability of endangered, threatened, and imperiled aquatic and riparian dependent species and plant communities.
    - Implement 15 IPPs to directly restore, recover or sustain endangered, threatened, and sensitive aquatic and riparian dependent species and plant communities.

  - At least 95% of the areas with federally listed water dependent species have existing or planned IPPs that secure the species in these reaches as much as they can be secured within the existing legal and water management context.
  - At least 90% of areas with identified sensitive species (other than ESA species) have existing or planned IPPs that provide direct protection to these values. Based on the map of environmental attributes generated for SWSI 2010 90% for individual species equates to approximately 169 miles for Colorado River cutthroat trout, 483 miles for roundtail chub, 794 miles for bluehead sucker, 700 miles for flannelmouth sucker, 724 miles for river otter, 122 miles for northern leopard frog, 921 miles for active bald eagle nesting areas and 229 miles for rare plants.

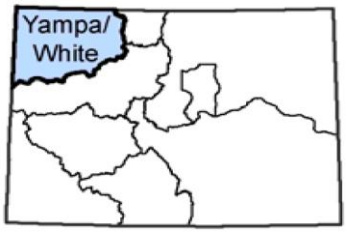
- Protect, maintain, monitor and improve the condition and natural function of streams, lakes, wetlands, and riparian areas to promote self-sustaining fisheries, and to support native species and functional habitat in the long term, and adapt to changing conditions.
  - Implement 26 IPPs to benefit the condition of fisheries and riparian/wetland habitat.
  - At least 80% of areas with environmental values have existing or planned IPPs that provide direct protection to these values.

Meeting the Southwest's Environmental and Recreational Gaps

The Southwest Draft BIP identified six environmental and recreational projects and methods that included stream mile information, which cover over 180 miles of stream. This is a subset of the 71 projects identified, and 93% of the stream miles are associated with riparian restoration in the Lower Dolores. If implemented, these projects are sufficient to meet the number of IPPs the Draft BIP has identified in the above categories. However, an analysis of how well these projects meet the percent of stream miles that need to have direct protection in each subbasin has not yet been conducted. Furthermore, these targets will likely be revised. The Draft BIP states, "By 2016, replace the following statewide outcomes with outcomes based on the current status of these measures in the Roundtable area" [9]. In addition, the Draft BIP identified two efforts that would extend across the sub-basin to better identify environmental and recreational needs:

1. Evaluation of environmental and/or recreational gaps is planned to be conducted for improvement of non-consumptive resources and/or in collaborative efforts with development of consumptive IPPs. The evaluations may be conducted by a subgroup of the Roundtable or by individuals, groups, or organizations with input from the Roundtable. The evaluation may utilize methodologies such as the Southwest attributes map, Flow Evaluation Tool, R2Cross, and any other tools that may be available.
2. Where environmental and/or recreational gaps are identified, a collaborative effort will be initiated to develop innovative tools to protect water identified as necessary to address these gaps.

Until the Basin Roundtable completes its reassessment of measurable outcomes, it is unclear how well the Draft BIP meets its measurable outcomes, but it is likely that it mostly meets its environmental and recreational gaps.



Yampa / White / Green

In the 2011 needs assessment, the Yampa, White, and Green Basin Roundtable identified 218 perennial stream miles with state imperiled warm water fish species, and 142 miles with federally listed warm water fish species. Approximately 55 percent of these stream miles have some level of protection, with most of it direct. Nearly two-thirds of the identified 35 perennial stream miles with Colorado River cutthroat trout have some level of protection, although most of this protection is indirect. Over three-quarters of the 275 miles of identified perennial stream miles with important riparian and wetland areas have some level of protection as well, with nearly all of it direct. The needs assessment report also identified various forms of recreation. Very few stream miles have identified protections for these values.

Yampa/White/Green's Environmental and Recreational Goals:
To address its environmental and recreational needs, the Yampa/White/Green Draft BIP identified two goals. These goals and the relevant measurable outcomes and processes are below [8]:

- Quantify and protect non-consumptive water uses.
    - To the extent that non-consumptive needs can be specified and projects can be analyzed, there will be projects for non-consumptive attributes within the existing legal and water management context.
    - Multi-purpose projects and methods will be researched and designed to meet the other goals enumerated here.
    - The PBO and its depletion coverage for the Yampa River Basin for existing and future anticipated and unanticipated depletions will meet base flow targets in critical habitat areas and assist with endangered fish recovery.
    - A new PBO is agreed upon for the White River Basin that provides certainty for existing and future anticipated and unanticipated depletions and that assists with endangered fish recovery.
    - The flow protection and any water leasing or re-operation of projects needed for native warm water fish, for cottonwoods, and for recreational boating on reaches with greater and overlapping flow alteration risks are integrated with the flow protection for endangered fish recovery and with projects to meet in- basin, consumptive needs. The flow needs of these non-consumptive attributes are otherwise met, including the avoidance or offset of the loss of minimum or optimal boating days that are related to multi-purpose projects and unrelated to drier or wetter hydrology.
    - The flow needs for all other non-consumptive attributes are quantified, integrated with projects to meet in-basin consumptive needs, and otherwise met through non-consumptive IPPs. Multipurpose projects will be researched and designed to improve riparian or aquatic ecology and bank stability without changing the existing flow regime while voluntarily modernizing irrigation diversion systems and reducing bedload. Similar projects will be researched and designed to improve

recreational boating for existing flows while voluntarily modernizing irrigation systems.
    - The economic values of the relatively natural flow regimes of the Yampa and White river systems are recognized and protected, along with the economic values of consumptive water use.
    - Acres of restored riparian areas, degraded streams, and wetlands to restore natural water storage capacity, and improve water quantity and quality for non-consumptive needs
    - Assess and quantify impact of IPP's on peak flows and ascertain whether further non-consumptive IPP's need to be identified.
- Develop an integrated system of water use, storage, administration and delivery to reduce water shortages and meet environmental and recreational needs.
    - Success in permitting and constructing in-basin storage projects
    - Reduction in consumptive shortages in drought scenarios
    - Reduction in identified non-consumptive shortages in drought scenarios
    - Administration and infrastructure improvements making decreed amounts of water available to
      diversion structures with less need for seasonal gravel dams in the river
    - Reduce the potential incidence of severe low flows in order for water users to exercise their water rights.

Meeting the Yampa/White/Green's Environmental and Recreational Gaps

The previous Watershed Flow Evaluation Tool work examined whether cottonwood, warm water fish, or cold water fish were vulnerable due to flow conditions within the Basin Roundtable's environmental and recreational focus areas. Additional analysis within the Draft BIP assessed how often instream flows and recreational in channel diversions were being met throughout the basin. These three efforts provide significant insight into how well environmental and recreational needs are currently being addressed in the basin. Furthermore, the Draft BIP overlaid potential future conditions within the basin to determine how future climate and development of its identified projects and processes would affect:

1. The vulnerability of the species within the environmental and recreational focus areas,
2. The instream flow shortages, and
3. The recreational in channel diversion shortages

For example, the Draft BIP indicates that "the modeling indicates that the implementation of the IPPs [in a dry future] would increase instream flow shortages by 27% on Trout Creek. The development of IPPs could reduce instream flow shortages on the following reaches: Oak Creek (by 1.4%, node 582290), Slater Creek (by 3.5%, node 542076)) and Willow Spring & Pond (by 1.8%, node 582162)" [10]. IPPs appear to have little affect for most locations due to vulnerability (Figure 6.2-5), but could modestly impact endangered fish recovery flows in the Yampa River during the fall and winter (Figure 6.2-6).

Overall, this work does an excellent job identifying the needs and the Draft BIP identifies seventeen environmental and recreational IPPs. These IPPs are further supported by five multi-purpose

projects and seven consumptive projects that could provide secondary benefits to environmental and recreational values. As stated in the Draft BIP, "the Basin Roundtable will continue to explore additional multi-purpose opportunities where they may exist through future planning efforts" [10].

In summary, the Draft BIP demonstrates progress towards meeting its future environmental and recreational needs and, if implemented, mostly meets the measurable outcomes listed above.

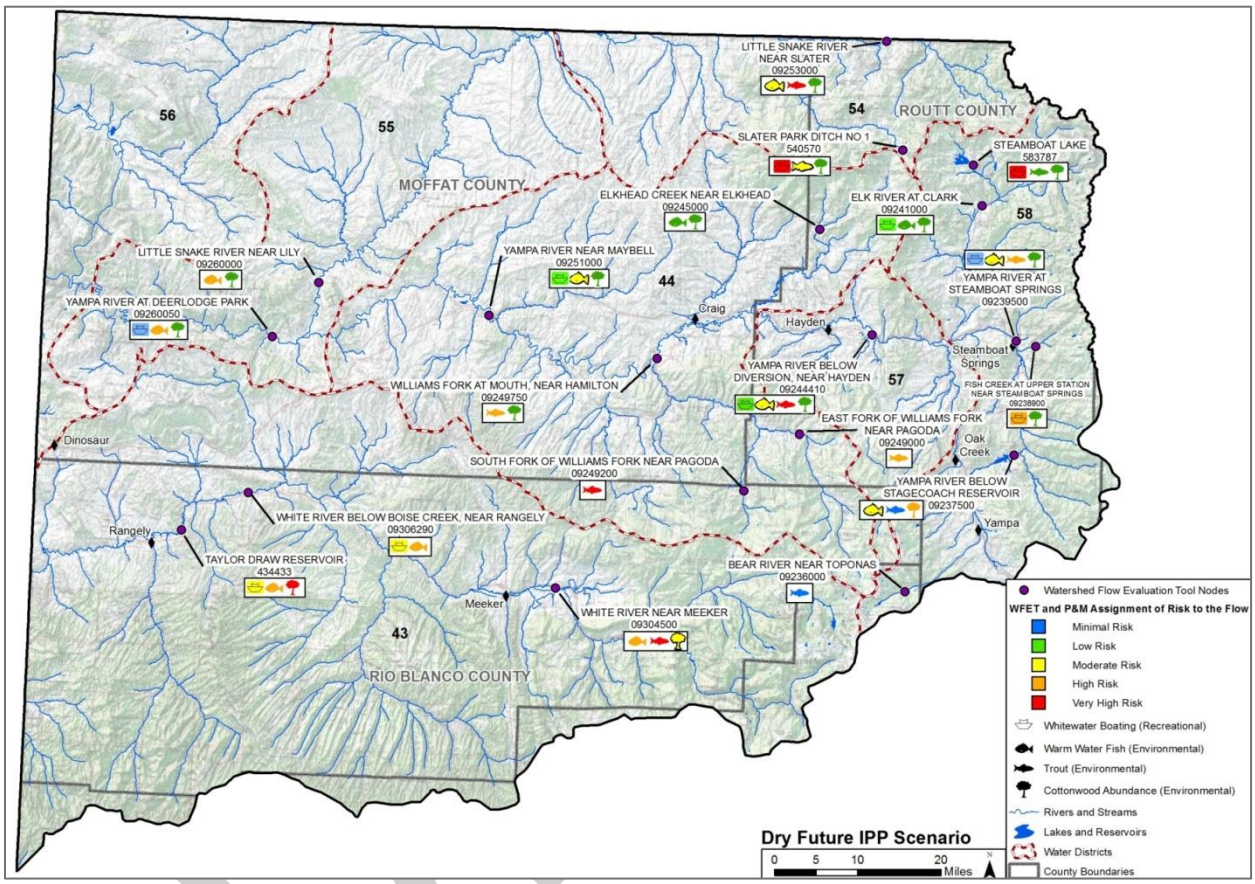
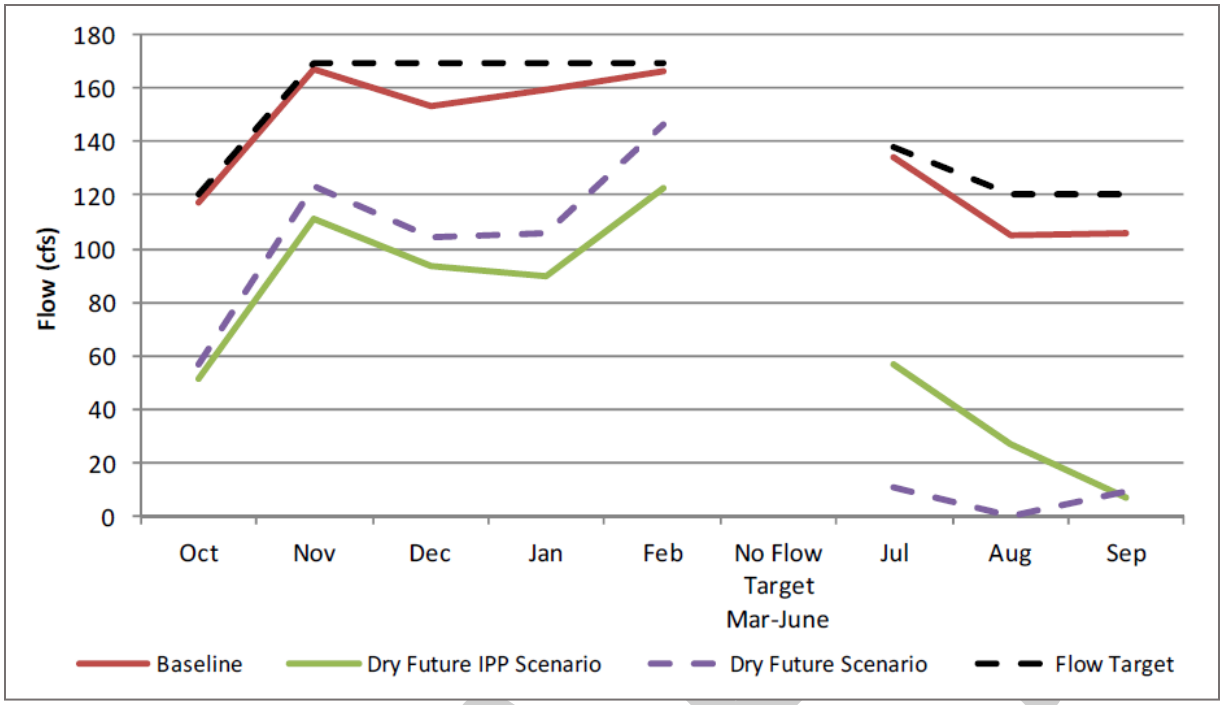


Figure 6.2-5 Vulnerability for warm water fish, trout, and important cottonwood riparian zones in the Yampa /White / Green in a dry future with identified projects and methods.



6.2-6 Demonstration of how the Yampa PBO could be impacted by a dry future and a dry future with identified projects and methods implemented

6.2.6 Other BIP identified gaps

Other needs identified by the Draft BIPs include those associated with education, watershed health, and water quality. These needs are further explored in section 9.4, 7.1, and 7.3 respectively.

6.2.7 How other states have worked to meet their gaps

The challenge of meeting future water supply needs is not unique to Colorado's boundaries. Other states across the west are facing the challenge of increased population and potentially limited supplies. Colorado's Water Plan will use the grassroots approach and input of citizens statewide to evaluate needs, and basin planning efforts will represent a huge step forward in meeting those needs. With greater certainty and strategy for meeting the state's needs within its borders, Colorado will be better prepared for working on interstate matters with neighboring states and the federal government. Other neighboring states have also undertaken water planning efforts, for better certainty at the intra- and inter- state level.

State and federal water projects make up a great amount of the ongoing efforts around the west: for example, California's State Water Project, the Central Arizona Project, and the Lake Powell Pipeline all represent massive financial and political undertakings, with the goal of meeting future water supply needs. Other efforts include water banking, with efforts underway in California as well as multistate efforts on the drawing board. A key issue in the west is also the settlement of water rights issues with tribes located throughout several states. Settlements in New Mexico and Arizona provide a greater certainty to tribes and to water management agencies within the state. Just as in Colorado, technical, financial, and political support are integral to the implementation of water supply projects and methods. The state of Texas has invested large sums of capital into project

implementation, Kansas has invested in Corps of Engineers' projects for storage, and the state of Utah has collaborated with the federal government on the Central Utah Project.

For more information on neighboring states' efforts to close water supply gaps, refer to the Appendix 6.2-A.

6.2.8 Next steps

The projects and methods in the Draft BIPs met many of the identified gaps, however in many cases gaps remain even with the significant efforts identified. In order to help the Draft BIPs meet their needs, several next steps are needed. The Gunnison Draft BIP summarized many of these next steps and potential actions, and this work has been updated in Table 6.2-5.

Category	Constraint	Next Steps and Potential Actions
Project Evaluation	Conflict	• Partnerships • Cooperative Strategies
	Perception	• Public Education and Outreach • Incentive-Based Programs
	Regulations	• Cooperative Strategies • Effective and Efficient Permitting
Project Feasibility	Cost	• Creative Funding Mechanisms • Partnerships and Cooperative Strategies
	Water Availability	• Water Availability Analyses • Water Administrative Strategies
	Constructability	• Feasibility Analyses • Engineering Design

Table 6.2-5 Strategies for implementation of the BIPs

One of the primary purposes of Colorado's Water Plan is to address the gap. In order to accomplish this, several of the next steps and potential actions identified in Table 6.2-5 are discussed throughout the plan:

- Partnerships and cooperative strategies are vital to overcoming conflict and building local consensus so that a project or method can move forward. This approach is further discussed in Section 9.3 on more effective and efficient permitting.
- Public education and outreach can also help inform people of Colorado's water needs and solutions. Section 9.4 explores avenues to better support this type of water education throughout Colorado.
- Incentive based programs are mentioned throughout many sections of Colorado's Water Plan. For instance Section 6.3 explores opportunities to encourage conservation, reuse and water-wise land use practices. Section 6.4 explores opportunities to encourage alternative agricultural transfer methods.
- Funding is also a common theme throughout many of the Draft BIPs. Funding options are further explored in Section 9.1.
- Permitting and other regulatory concerns are also expressed in many of the Draft BIPs, and section 9.3 explores how to make these processes more effective and efficient.

Furthermore, Colorado's water gaps must be identified and addressed. The following recommendations would help accomplish this.

- Support the evaluation, feasibility, and completion of the BIPs through WSRA grants.
- Support increased consistency and technical support in the BIPs.
    - Provide technical support for several of the BIPs to explore municipal, agricultural, industrial, and environmental shortage analyses similar to those found in the Yampa/White/Green Draft BIP.
    - Provide technical support for several of the BIPs to explore the utilization of project sheets and project tiering, similar to the Rio Grande, North Platte, and Gunnison Draft BIPs.
    - Support the further quantification of project and methods costs, new acre-feet developed, new irrigated acres developed, and new stream miles protected.
- Incorporate the BIP information into SWSI 2016 and reassess the municipal, industrial, environmental, recreational, and agricultural gaps

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Appendix 6.2-A: How other states have worked to meet their gaps

Arizona:

Arizona Water Banking: The Arizona Water Banking Authority (AWBA; Water Bank) was established in 1996 to increase utilization of the state's Colorado River entitlement and develop long-term storage credits for the state. The five person board is made up of the Director of the Arizona Department of Water Resources (ADWR), who is chair, the President of the Board of the CAP and three persons appointed by the Governor. AWBA "banks" unused Colorado River water to use in times of shortage to firm Arizona's water supplies. These water supplies help to benefit municipal and industrial users and communities along the Colorado River, fulfill the water management objectives of the state, store water for use as part of water rights settlement agreements among Indian communities, and assist Nevada and California through interstate water banking. Through these mechanisms, the AWBA aids in ensuring long-term water supplies for Arizona.

Each year, the AWBA pays the delivery and storage costs to bring Colorado River water into central and southern Arizona through the Central Arizona Project canal (this is a federal/municipal project and is 336 miles long). The water is stored underground in existing aquifers (direct recharge) or is used by irrigation districts in lieu of pumping groundwater (indirect or in-lieu recharge). For each acre-foot stored, the AWBA accrues credit that can be redeemed in the future when Arizona's communities or neighboring states need this backup water supply.

Central Arizona Project: The first State Water Plan published in the mid-1970's noted that the growth of Arizona cities and industries could only be assured if groundwater pumping was offset by the use of CAP water. In the late seventies, there was an impasse between the farmers and the municipal and mining interests regarding groundwater management. Governor Bruce Babbitt

convinced the U.S. Secretary of the Interior at that time, Cecil Andrus, to issue an ultimatum: unless Arizona enacted tough groundwater laws, he would refuse to approve construction of the Central Arizona Project.

Soon the cities, mines and agriculture asked Babbitt to mediate the discussions regarding groundwater. One of the first items of agreement was creation of the Arizona Department of Water Resources. CAP was completed in 1993, costing $3.7 billion to construct. The Arizona Department of Water Resources continues to financially support the project, but it is primarily run by a regional commission and was approved by Congress as a federal project.

California:

State Water Project: California has a State Water project, which provides drinking water for over 25 million people and generates an average 6.5 million MWh of hydroelectricity annually. It also provides water to 750,000 acres of irrigated land. Construction began in the late 1950s, with major funding approved through a 1960's bond measure. Bond measures paid for the majority of the project, and annual operation and maintenance costs (including debt service) are primarily paid for by beneficiaries, although the state pays for the fish and wildlife benefits. The state water project is ongoing, with additional facilities being planned. The project started as a state-supported federal project.

Quick Facts

- The Project includes 34 storage facilities, reservoirs and lakes; 20 pumping plants; 4 pumping-generating plants; 5 hydroelectric power plants; and about 701 miles of open canals and pipelines.
- By the end of 2001, about $5.2 billion had been spent to construct SWP facilities.

CALFED Bay-Delta Program: In 1994 California and federal entities signed an agreement to manage the competing demands in the Sacramento-San Joaquin Delta. There are numerous competing environmental and water supply needs related to the Delta. This is a large and ongoing component of the State Water Project.

In July of 2012, Governor Jerry Brown joined Secretary of the Interior Ken Salazar to announce plans to move a project forward that would put two tunnels under the bay to stabilize water deliveries, which have been reduced by court order over concerns for the endangered Delta Smelt. This is the latest version of the peripheral canal. There is significant opposition to the project from environmentalists, salmon sports fishermen, and local farmers, although Governor Brown said the tunnels would be the "preferred alternative" for a plan that would ensure the "co-equal" goals of reliable water supplies and delta habitat restoration. There will still be permit requirements, and an analysis is due next year.

Quick Facts:

- The project could deliver up to 7 million acre-feet.
- The proposed system would cost about $19 billion to build, operate, and manage, along with $3-4 billion for habitat restoration.

- The habitat costs would be funded through bonds that would be paid from the state's general fund and would require voter approval. Water users will pay for the cost of the construction and operation of the tunnels.

Read more: http://www.sfgate.com/science/article/New-state-water-plan-tunnels-under-delta-3735999.php

State Water Plan: California also has a State Water Plan. Their five year update was published in 2013, and includes a financial plan, which is "a necessary step in implementing the strategic plan and many other California Water Plan recommendations. This new financial focus will identify critical priorities for State investment in integrated water management activities. It will also recommend innovative, stable, equitable, and fiscally responsible financial strategies and revenue sources should any funding gaps be identified as part of the water plan's development." The plan will also focus on regional solutions.

Colorado:
In addition to the technical and financial support provided by almost every state, Colorado has supported several projects in various ways. These include being a participant in a project (e.g., Chatfield Reallocation), purchasing a block of water to be able to market to various interests in the future (e.g., Animas-La Plata), providing loans and/or grants to assist a project in moving forward (e.g. Prairie Waters, Arkansas Valley Conduit), and the passing of a CWCB resolution in support of a project (e.g., Chatfield Reallocation, WISE Partnership). Several Governors have also weighed in on water projects, including pressure to move permitting forward and explicit support for specific water projects. The latest example can be found here: http://www.denverpost.com/news/ci_21314294. Other support includes working with water providers who are working collaboratively with other stakeholders to find creative ways to administer these projects.

New Mexico:
Regional Water Planning: The New Mexico Legislature created the state's regional water planning program in 1987 and gave the Interstate Stream Commission the responsibility of funding, overseeing, and approving the plans of the 16 regions. Through the program, regions are charged with the inventory of existing water supplies, projecting future demand, identifying supply inadequacies, and developing strategic alternatives to meet supply shortages. The New Mexico State Water calls for the State to "support and adequately fund the completion, update, and implementation of regional water plans."

San Juan-Chama Project and Navajo Nation Water Rights Settlement: The Governor, State Engineer, and the Interstate Stream Commission Director testified in support of the Settlement and associated Project. The State contributed nearly $50 million dollars to the project.

Taos Pueblo Water Rights Settlement: The Governor, State Engineer, and Interstate Stream Commission Director testified in support of the Settlement. The State, has contributed $1.5 million dollars while agreeing to future appropriations of $18.5 million dollars over time.

Aamodt Water Rights Settlement: The Aamodt Settlement (Pueblos of Pojoaque, Tesuque, Nambe & San Ildefonso) was supported by the Governor, State Engineer, and the Interstate Stream Commission Director. No appropriations have been made to date, yet the State is potentially on the hook for up to $50 million dollars.

Eastern New Mexico Water Supply Project: The Governor, State Engineer, and the Interstate Stream Commission Director supported the Settlement. The State has contributed $20 million dollars while agreeing to fund around $75 million dollars over time.

San Juan-Chama Shortage Sharing Agreement: The parties involved in the Navajo Dam and San Juan River operations, together with the New Mexico State Engineer's Office and the Bureau of Reclamation, came to an agreement to share water losses (as opposed to traditional state water rights administration). If the shortage agreement is not adhered to, the State will administer the system in a conventional manner.

Texas:

Texas has an active regional planning effort that identifies projects and then works to fund projects that are consistent with the plan or, for some funding sources, explicitly recommended as water management strategies in the regional or state plans. They also have their own Commission on Environmental Quality which grants water right permits only if (some exceptions do apply) they are consistent with the regional water plans and the state water plan. The plans are updated every 5 years, and the Texas Water Development Board provides technical and administrative support. The legislature also designates "sites of unique value for the construction of reservoirs" as well as stream reaches with "unique ecological value." There are several recommendations in the 2012 state plan that have not yet been implemented. These include the recommended purchase of reservoir sites and implementation of specific water projects and methods that go through an evaluation process.

Quick Facts

- Municipal conservation strategies are expected to result in about 650,000 acre-feet of supply by 2060, with irrigation and other conservation strategies totaling another 1.5 million acre-feet per year.
- The planning groups recommended 26 new major reservoirs projected to generate approximately 1.5 million acre-feet per year by 2060. Other surface water strategies would result in about 3 million acre-feet per year.
- Recommended strategies relying on groundwater are projected to result in about 800,000 additional acre-feet per year by 2060.

Utah:

Lake Powell Pipeline: Utah is planning, buying up the right of way, and has financing in place for construction of the Lake Powell Pipeline, to deliver water from the Colorado River (from Utah's unused allocation) to the St. George area in Southwest Utah. Utah's Board of Water Resources, under the Lake Powell Pipeline Development Act passed by the Utah State Legislature in 2006, is authorized to build the Lake Powell Pipeline. The legislation authorizes a pipeline to take

water from Lake Powell, and transport it to Washington, Kane and Iron counties. The water diverted into the pipeline will be a portion of Utah's Upper Colorado River Compact allocation, and will consist of water rights to be held or acquired by the three water districts and the Board of Water Resources. The state will build the project and the districts will repay the costs through water sales.

Quick Facts

- The pipeline will total 177 miles from Lake Powell to Iron County
- The project will deliver 100,000 acre-feet
- Deliveries are planned to begin in 2020
- The project will cost over $1B in capital costs

West Desert Pumping Project: The Utah legislature authorized a major pumping project to protect the risk of flooding out of the Great Salt Lake.

Bear River Development: Bear River is often referred to as Utah's last untapped river. In the Bear River Development Act, passed by the Legislature in 1991, the Division of Water Resources is directed to develop the surface waters of the Bear River and its tributaries. The act also allocates water among various counties and provides for the protection of existing water rights. The act allocates a total of 220,000 acre-feet of water annually. The total cost of the project is estimated to be between $130- 260 million, depending upon which dam site is chosen. Most of the required conveyance and treatment systems will be the responsibility of the contracting entities. An article in the Utah Environmental Law Review states "According to several administrative documents, the state intends to make Bear water available within the next two decades, and it appears that the state will finally push forward to realize their 60 year old desire to tap the Bear." This article can be accessed here: http://epubs.utah.edu/index.php/jlrel/article/viewArticle/103. It is unclear in this initial review what the state intends to do with this project in the near future.

Central Utah Project: The Central Utah Project (CUP) is a state supported federal project. CUP is being constructed by the U.S. Bureau of Reclamation and the Central Utah Water Conservancy District (CUWCD) took over construction of some of the final water distribution components. The project is explicitly listed in the Utah's State Water Plan as being necessary. It is located in the central and east central part of Utah. It is the largest water resources development program ever undertaken in the State. The project provides Utah with the opportunity to beneficially use a sizable portion of its allotted share of the Colorado River water. Project irrigation water will be provided to Utah's rural areas in the Uintah and Bonneville Basins. Water will also be provided to meet the municipal and industrial requirements of the most highly developed part of the State along the Wasatch Front where population growth and industrial development are continuing at a rapid rate. Water developed by the Central Utah Project will be used for municipal, industrial, irrigation, hydroelectric power, fish, wildlife, conservation, and recreation. The project will improve flood control capability and assist in water quality control

One key component of the project is the Bonneville Unit - This complex unit is currently being constructed and includes 10 new reservoirs, more than 200 miles of aqueducts, tunnels, and canals; a power plant, pumping plants, and 300 miles of drains. Starvation Reservoir, constructed on the Strawberry River about 3 miles above Duchesne, has a capacity of 167,000 acre-feet and Soldier

Creek Dam has nearly quadrupled the capacity of Strawberry Reservoir from 283,000 to 1,106,500 acre-feet.

Other States:
Wyoming: The Wyoming Water Development Commission has financed many projects, including the State's share of the cost of raising Reclamation's Buffalo Bill Dam.

Kansas: Kansas purchased storage in Corps reservoirs for water supply uses.

[i] Perennial streams are derived from the USGS national hydrologic database.