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Chapter 5: Water Management

INITIAL DRAFT 5.6: Water Conservation and Reuse

NOTE: This draft section will be modified and supplemented upon receipt of the draft Basin Implementation Plans from the Basin Roundtables and additional work completed by the IBCC.

Introduction

As Colorado heads towards a gap between supply and demand, water conservation activities will play an important role in balancing the need for additional water supply against what can be done to lessen that need. By creating a comprehensive statewide approach to implementing water conservation activities, we can create a consistent approach from the local level up to the state level. While conservation and reuse are not "silver-bullets," we can achieve the benefits of conservation by creating scalable technical resources, bolstering local initiatives through financial incentives, and sharing best-practices at local and state levels.

This section examines active water conservation, passive water conservation, reuse, land use, agricultural water conservation, self-supplied industrial conservation, and state agency conservation. These various water management strategies will define the road that Colorado will take to close the supply gap, maintain a healthy environment, and preserve agricultural production into the future.

5.6.1 M&I Water Conservation

As described in section 5.1, no matter what future Colorado faces, a significant amount of conserved water will be needed to ensure that we have enough water to meet Colorado's future needs. The minimum saved water identified by the IBCC is nearly 170,000 acre-feet, which is enough water to meet the needs of about 1.1 million people, which is equivalent to thirty percent of all the new people expected to move to Colorado between now and 2050 (No/Low Regrets, 2013). There have been a number of stakeholder-based efforts such as the 2010 Statewide Conservation "mini-summit," work of the IBCC Conservation Subcommittee, and work of the CWCB's Water Conservation Technical Advisory Group, that have helped to 1) determine the minimum levels of conservation needed and 2) chart potential ways to achieve these levels of active conservation. We must also recognize that conservation acts as a management tool to buffer against drought. Water managers reduce demands through conservation over the long term and also in times of drought when water is scarce. The amount of water realized from long term water conservation could be used as drought reserve. In these cases, greater storage is required to maintain drought protection (Mayer, Little & Ward, 2006).

Benefits of Water Conservation

The CWCB *Municipal Water Efficiency Plan Guidance Document* states that water savings achieved through water efficiency activities can reduce water demands assisting providers in avoiding, downsizing, or postponing the construction and operation of water supply facilities and wastewater facilities as well as eliminate, reduce, or postpone water purchases. In addition to these water supply benefits, there are other societal, political, and environmental benefits. Examples of such benefits include:

- Reduction of wastewater discharges through indoor water savings which can improve water quality and aquatic habitat.
- Reduction of outdoor irrigation runoff which can improve water quality.
- Demonstrating commitment to sustainability.
- Meeting political and regulatory requirements necessary to obtain permitting for local and regional water supply projects.
- Demonstrating leadership to the community that being more efficient is the right thing to do in an arid environment.
- Lowering operational costs such as pumping and water treatment.
- Lowering amount of chemicals needed to treat water.
- Delaying capital costs for projects

Benefits may also be reflected in how the saved water is used. Depending on a provider's water supply portfolio and situation, saved water can be used in the following ways:

- Conserve water for future generations – Saved water can be a less expensive option than acquiring new supplies for future growth and result in less environmental consequences.

- Leases to agriculture – This supports the agriculture sector and can generate additional revenue for the municipality.
- Drought protection – Saved water can be stored for later use during a drought. This in turn improves water supply reliability without having to purchase additional water.
- Instream flows – Saved water may remain in the stream. This can increase flows in particular reaches of the stream.

State of Knowledge on Water Conservation

In 2010, the CWCB funded a first ever *Best Practices Guidebook for Municipal Water Conservation in Colorado* (Best Practices Guidebook). Colorado WaterWise created the Best Practices Guidebook with a large technical and stakeholder group and created fourteen best practices that outline the potential and costs for active water conservation measures that span indoor to outdoor to residential and non-residential. These best practices comprise what a water provider would have to carry out in order to conserve water. They require financial and human resources to accomplish and implementation varies greatly among water providers.

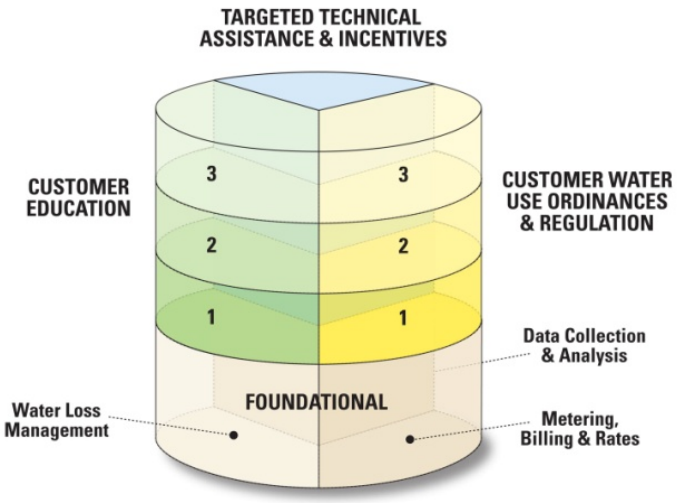

Figure 2-SWSI Levels Analysis Framework

The CWCB created the Levels Analysis Framework that prioritizes the best practices that a local water provider might undertake to achieve its goals. The Levels Analysis focuses on foundational practices first and then proceeds in varying degrees of difficulty organized by technical assistance and incentives, regulations, and education. This will help water provider personnel focus both human and financial resources on the most cost efficient activities (most acre feet saved/resources expended) first and then with time expand to attain the more difficult activities.

Using the Best Practices as a basis, SWSI 2010 estimated low, medium and high strategies for active water conservation savings. Active water conservation is water conservation that occurs due to the enactment of programs at the local level where financial and human resources are committed to carrying out water efficiency programming. Depending on the level of savings, a varying amount of effort is required to achieve penetration rates consistent with the savings estimates. Many of the activities that would attain the medium to high savings estimates were estimated to require some kind of regulation to ensure the success of the savings estimates. The total potential savings ranges from 160,000 to 461,000 acre feet statewide in 2050 (CWCB 2010 b).

Not all of these savings can or should be applied to meet future growth. Not every municipality that conserves water will need all of it to meet future growth, and there are legal barriers that restrict water providers from sharing conserved water. In addition, most entities do not have the infrastructure to either share water or re-time conserved water so that it can be used when it is

needed. In addition, some entities may choose to utilize conserved water as part of their strategic drought reserve. Initial estimates by the roundtables indicate that between fifty and sixty percent of conserved water could be used to meet future growth. Approximately 170,000 acre-feet was determined to be the plausible amount that could be applied to meet future needs, no matter what type of future Colorado may face.

In addition to this amount, another 150,000 of savings will likely accrue by 2050 due to natural replacement rates of fixtures and appliances (CWCB, 2010a; CWCB, 2010 b). These passive water conservation savings occur when home and property owners need to replace their indoor water fixtures and appliances. Their choices tend to save water compared to old appliances and fixtures due to large-scale regulatory or legislative initiatives such as the Energy Policy Act of 1992 (1992 EPACT). Passive water conservation can be considered a baseline of water savings that will occur naturally and thus should be included in demand projections. As customers replace their toilets, dishwashers, clothes washers, showers and the like, many will choose WaterSense or EnergyStar labeled fixtures and appliances, which use less water. This will be further supported through recent legislation (see below).

Examples of Exemplary Water Conservation

Municipalities have done a remarkable job in the past decade reducing per person water needs. Statewide, this amounts to a little under twenty percent (SWSI 2010), but some municipalities have reduced their per person water use by as much as thirty percent. Others have developed regional and cooperative approaches to reduce water use. Most of the largest water providers in Colorado have CWCB approved water conservation plans and most of the M&I demand is covered by an approved CWCB plan.

Many water providers have adopted best practices, including landscape practices, water loss management and inclining block rate structures. For example, of the CWCB approved water conservation plans on file, approximately 85% of water providers along the Front Range and East Slope and 77% of West Slope water providers have inclining block rate structures (CWCB, 2011). Below are a few examples that highlight some efforts. There are many more great examples of water conservation across the state, but there is not room to include them all.

- *Aurora Water*
  Aurora Water has implemented landscape and irrigation standards along with tiered rate structures. Additionally, they are creating a customer information system using geographic information systems, excel based water use calculator and state of the art communication tools to efficiently focus incentives to specific customers and to collaborate with their customers more closely.
- *Douglas County*
  All covered entities in Douglas County have CWCB approved water conservation plans and the vast majority of the smaller providers manage water conservation activities under a regional water conservation plan. Of the covered entities, all are implementing water conservation best practices such as landscape/irrigation ordinances, landscaper certification requirements, a variety of incentives, tiered rate structures (including water

budgets), smart metering with a customer feedback loop, new construction requirements in relation to water conservation and customer education.

- *Denver Water*
  Denver Water has made progress through their "Use Only What You Need" campaign over the last 8 years. Now they are taking that one step further with creating water budgets for their largest customers and customizing their efficiency approach with each one. This way their largest customers know exactly "what they need" and can be more efficient with their water use.
- *Greeley, Boulder, Highlands Ranch and Castle Rock*
  All of these municipalities have adopted water budget rate structures tied to actual water use on a site. Using winter quarter average as a proxy for indoor use and GIS imagery to define water use outside, these communities have used this tool to manage their summer peak demands through technology, education and appropriate pricing.
- *Ute Water/Grand Junction/Clifton*
  Starting in 2002, the Grand Valley Water Providers came together to create a drought response plan called DRIP or Drought Response Information Project. This was a success and is still in action. Modeling this effort, they came together again to create a regional water conservation plan. This effort made sense since their systems are interconnected and generally reside in the same media shed.
- *More Regional Plans*
  Many communities and water providers are not required by statute to have a CWCB approved conservation plan due to their small size. These small water providers can however come together and create more than the sum of their parts.
    - In the lower Arkansas Valley, 38 small water providers came together to create a regional water conservation plan, under guidance from Southeastern Colorado Water Conservancy District, as a roadmap of how they were going to plan and implement conservation over the next 50 years.
    - Steamboat Springs completed a community conservation plan that brought together three water providers under a single community plan in 2010.
    - Presently, five communities in the Roaring Fork Watershed (Aspen, Snowmass Village, Basalt, Carbondale and Glenwood Springs) are creating their own regional conservation plan that ties directly into their Roaring Fork Watershed Plan.

Basin Implementation Plans

For 2014, each Basin Roundtable is formulating their own implementation plan that will include water conservation goals and activities in addition to already planned projects and methods, use of Colorado River water, and alternatives to agricultural transfers.

SUMMARY OF BIP WORK TO DATE IS BELOW. THIS WILL BE UPDATED BASED ON BIP WORK.

A number of basins have created the following draft goals (Initial Draft Statewide Basin Implementation Plan Goals, 2014)

The Arkansas Basin has submitted a WSRA grant that explicitly aims to further explore conservation.

The Colorado Basin has created a goal "to develop land use policy improvements addressing conservation and awareness of limited available water supply and develop water court process recommendations to encourage efficiency, conservation, and reuse."

The South Platte/Metro Basin has an overarching theme of continuing "its Leadership Role in Efficient Use and Management of Water - No person, company or institution operates without risk/ perils of change. The State's future, and the future of each of its river basins, depends on efficient, sustainable and collaborative solutions." They also have the following goals and measurable outcomes:

Goal: Continue the South Platte River Basin's leadership in wise water use.

- MO#1 – 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.
- MO#2 – 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.
- MO#3 – 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.
- NC MO#1 – Ensure conservation, reuse and drought management plans take into consideration environmental and recreational focus areas and attributes.

Finally, the Southwest Basin has a "goal of promoting and incentivizing wise and efficient water use through implementation of municipal conservation strategies to reduce overall future water needs".

Each Basin is in the process of compiling all of their strategies for closing their M&I gap. These are preliminary goals and as more plans are fleshed out more goals will be finalized.

Interbasin Compact Committee (IBCC) Actions

In 2010, the IBCC Water Conservation Subcommittee developed a list of water conservation strategies that were included in an IBCC "Letter to the Governors" (IBCC Report to Governors, 2010). Among the recommendations were a number of short-term and longer term conservation actions that ranged from statewide education campaigns to legislation addressing indoor and outdoor water use.

In 2013, the IBCC developed the "No and Low Regrets Action Plan" for water conservation (No/Low Regrets, 2013). This strategy outlines what minimum level of water conservation should be carried out statewide. The IBCC reached consensus on the need to reach low to medium levels of water conservation regardless of the future scenario, and the near term potential future actions that would be needed to achieve this (Table 1).

Table 1: Interbasin Compact Committee Potential Future Actions Summary

1) **Improve Tracking and Quantification of Conservation**
2) **Establish a Statewide Conservation Goal with Intermittent Benchmarks**
   a) Develop general political support for a statewide conservation goal
   b) Develop statewide agreement tying conservation to new supply development and agricultural transfers
   c) Support local entities in their efforts to outline and report their own approaches to help achieve the statewide goal.
   d) Explore best approach to implementation of standards to achieve goal
   e) Develop and implement conservation standards
3) **Continue to Support Local Implementation of Best Practices**
   a) Continue implementation of state conservation programs
   b) Encourage use of levels framework and best practices guidebook
4) **Promote Enabling Conditions for Use of Conserved Water**
   a) Maintain and develop storage and infrastructure for the use of conserved water
   b) Promote incentives for the use of conserved water
   c) Identify and, where possible, resolve legal and administrative barriers to the use of conserved water
   d) Identify and explore barriers to sharing conserved water
5) **Develop New Incentives for Conservation**
   a) Explore funding options in support of the Water Efficiency Grant Program
   b) Develop professional education and certification programs
   c) Develop new eligibility requirements for state grants and loans that include certain conservation levels or indications of commitment to conservation
   d) Develop conservation standards for communities planning to use agricultural transfers or new supplies for future water needs
   e) Develop incentives that incorporate the following concepts: encourage a base level of conservation; assess issues, benefits, and drawbacks of the current definition of "covered entities;" conservation water markets; small community support; permitting incentives
6) **Explore Legislative Concepts and Develop Support**
   a) Explore legislative options and support for indoor plumbing code standards
   b) Explore legislative options and support for outdoor water efficiency standards
   c) Engage in outreach and education efforts to explain the need for legislation; develop political support
7) **Implement Education and Outreach Efforts**
   a) Track public attitudes through baseline and ongoing surveys
   b) Develop statewide messaging and use focus groups to refine and guide implementation
   c) Develop decision-maker outreach strategies
   d) Pursue a coordinated media campaign

Recent Legislative Actions

Partly in response to the work of the Basin Roundtables and the Interbasin Compact Committee, there have been some recent legislative developments. The legislative process can be contentious and does not always reflect the collaborative nature found at the Basin Roundtables and Interbasin Compact Committee. Many of the Basin Roundtables have expressed an interest in working more closely with their legislative representatives to increase the level of understanding for both bodies. As in this session, there have been bills passed in the last few years that will direct the course of statewide water conservation implementation for the foreseeable future.

Senate Bill 14-017, concerning a limitation on the approval of real estate developments that use water rights decreed for agricultural purposes to irrigate lawn grass, was passed by the General Assembly and signed by the Governor in 2014. The bill seeks to identify and quantify the types of best practices that could be used to limit municipal outdoor water conservation and to determine if proposed legislation is needed to facilitate the implementation of those practices. The bill directly refers to the work of the Basin Roundtables and the IBCC, stating, "As part of the Colorado water conservation board's statewide water supply initiative and the interbasin compact committee and basin roundtable process, a "No/Low Regrets Action Plan" has been developed, an important element of which is to establish an implement conservation strategies to extend the ability of existing water supplies to meet increasing needs and thereby minimize agricultural dry-up."

Senate Bill 14-103, known as "the fixtures bill," was passed by the General Assembly. It would phase out less efficient water using fixtures and requires that only WaterSense specified fixtures may be sold in Colorado. These fixtures are those fixtures that carry the EPA WaterSense label, are third party certified and presently are 20% more efficient than existing fixtures. In addition, these fixtures do not cost more than their less-efficient counterparts. The bill's supporters estimate that it would garner approximately 40,000 acre feet of savings annually by 2050 and would increase the replacement rate of existing fixtures. (Denver Water, 2014). The bill is consistent with the Interbasin Compact Committee's suggestion to explore legislative options to help increase indoor water efficiencies.

Past Legislative Actions

HB 10-1051 will have a long lasting impact on how Colorado plans for water conservation. This bill that requires covered entities (those water providers that deliver over 2000 acre feet of water annually) to submit water use and water conservation data to the CWCB. This is a good first step to better quantifying and tracking water conservation activities and water demand in Colorado. This bill is being implemented in 2014 and the data will be valuable to state water supply planning processes.

HB10-1358 required the builder of a new single-family detached residence, for which a buyer is under contract, to offer the buyer a selection of water-saving options, including:

- Water-efficient toilets, lavatory faucets, and showerheads;
- Dishwashers and clothes washers that meet federal Environmental Protection Agency energy star program standards if they are to be financed, installed, or sold as upgrades through the home builder;

- If the landscaping is financed, installed, or sold as upgrades through the home builder and maintained by the homeowner, landscape design that follows the Green Industry's best management practices; and
- Installation of a pressure-reducing valve that limits water pressure in the residence to 60 pounds per square inch.

As a side note, SB 14-103 would effectively remove the first bullet above that relates to water efficient toilets, faucets and showerheads in order to streamline legislation and avoid duplication.

HB 09-1129 authorized a pilot program for the collection of precipitation from rooftops for nonpotable uses. The program can include up to 10 new residential or mixed-use developments. At present, the Sterling Ranch development in Douglas County is the first and only pilot to begin and is at the beginning of their first construction phase.

HB 05-133 stated that an owner would not abandon their water right if certain conditions were met. Two conditions refer to "a water conservation program approved by a state agency and a water banking program as provided by law". These don't go as far as allowing sharing but it does state that an owner of a water right won't lose the right if non-use stems from water conservation activities.

Water Conservation Recommendations

THIS WILL BE UPDATED TO REFLECT BIP CONSERVATION WORK.

In the past decade, great strides in understanding and implementing water conservation activities have taken place across Colorado. Most of the largest water providers in Colorado have CWCB approved water conservation plans, most of the M&I demand is covered by an approved CWCB plan, Colorado-specific Water Conservation Best Practices were created, SWSI 2010 refined water savings projections to reflect current industry knowledge, House Bill 10-1051 was passed and implemented to collect current water use and water conservation data and local water providers are implementing more measures than ever before.

With all these successes there is still much to do. Incentives and technical resources will assist in creating a space where more measures can be implemented but local regulation will have to be implemented to attain higher level of water conservation as well as the focus on foundational activities within a water provider's water system to ensure that water systems are operating as efficiently as they can.

- **Foundational Activities:**
  A comprehensive focus on foundational activities at the water system level will be necessary to attain water efficiency and support the business practices of local water providers. Conservation oriented rate structures, such as water budgets, comprehensive water loss programs using industry standard water auditing practices and improved data collection on customer water uses are all foundational practices that should be carried out by all utilities. Implementation of these practices supports a water provider's business model and helps to assure revenue stability and efficient use of resources. The foundational

activities could be incentivized or tied to regulatory vehicles such as local land use codes or water system connection requirements.

- **Better Tracking and Quantification:**
  Advances have been made over the last decade in tracking and quantifying water conservation data. With the passage of HB10-1051 into C.R.S 37-60-126 (4.5), the CWCB can now collect annual water use and water conservation data from covered entities across Colorado. This is a necessary first step for tracking demands and water conservation program savings but will need to be expanded upon to include creation of savings tracking tools as well as savings estimating tools. For the typical water provider, water conservation savings are estimated using rules of thumb and not by analyzing actual demand reductions at the customer level. With creation of more technical resources, a water providers' ability to estimate savings will improve, reliability of these savings will increase and the input into future BIPs will improve as well. This is consistent with the Interbasin Compact Committee's first No and Low Regret Action.

  Additionally as passive savings are attained they will have to be monitored closely. Whether we reach these savings and decide to increase the savings goal will influence how we proceed in terms of adopting new, higher efficiency standards in the future. Part of this would be the option to adapt to increasing efficiencies in technologies that are created for the marketplace. Specifically, this speaks to the adoption of WaterSense specifications for indoor fixtures as well as adoption of WaterSense specifications for outdoor technology. If products that meet these levels of water efficiency are sold in Colorado's marketplace, we will be more assured of reaching passive levels of water conservation savings by 2050. Additionally, monitoring progress and adopting these standards creates certainty for garnering savings as well as for the marketplace. This process creates a minimum standard that can be adapted easily to accommodate higher efficiency technologies as they are created and certified.

- **Incentives for outdoor water conservation measures:**
  Outdoor water conservation is an area that has been touched on in the past decade but efforts have not gone very deep. This sector of water use, along with the commercial, industrial and institutional sector, will be the most important to address in the coming years. For example, incentives for retrofitting higher water landscape with lower water landscapes, more efficient irrigation systems and siting higher water use landscapes to create more appropriate use areas would help garner higher levels of water savings. Addressing outdoor water use creates multiple benefits like water savings, smarter growth patterns and less runoff of pollutants to urban water ways. This is consistent with SB14-017 and the IBCC's No and Low Regrets Action Plan.

- **Water Conservation Education and Outreach:**
  Implement far reaching water conservation education and outreach measures for creating water stewards across different segments of the population from children to adults to elected officials to citizens. A comprehensive education program will tie together the other actions illustrated within this section and provide the "why" for carrying out these actions. These efforts could be rooted in each BIP and carried out to address specific issues that

occur in each basin. As part of this work, surveys of public attitudes will need to be carried out and partnerships with water providers and other water educators will also be critical in accomplishing this task. From a water conservation perspective Colorado WaterWise, a water conservation non-profit organization, could assist in carrying out water conservation and stewardship education messaging across the state. The recommendation is consistent with the No and Low Regrets Action Plan.

- **Multi-Scale Regulation:**
  - As savings become more difficult to achieve local regulatory efforts to shape how new construction interacts with water use may be necessary to accomplish local water conservation goals. For example, local jurisdictions could craft landscape and irrigation ordinances, tap fees that reflect actual water uses and more stringent green construction codes that include higher efficiency fixtures and appliances and more waterwise landscapes. Some examples include:
    - Aurora Water crafted a comprehensive set of landscape and irrigation standards with the City of Aurora's Planning department.
    - The City of Westminster has tap fees that reflect water usage for new development and is backed up by landscape and irrigation standards.
    - Town of Telluride has a rigorous green building requirement for new construction, remodeling and additions that includes indoor and outdoor water conservation measures.

    This has a direct connection to land use patterns and codes and should be considered as a comprehensive way to address the statewide water supply gap.
  - On a larger scale, possibly the state level, more robust professional education and certification programs for the landscape industry could assist in creating a more water efficient ethic across Colorado. Industry best practices could be tied to local ordinances making a consistent approach for the landscape industry to be more successful and be more water efficient. Green Industries of Colorado (GreenCO) have shown support for this type of regulation in the past as a way to level the playing field and encourage the highest level of professionalism.

- **Partnerships**

  Partnerships will be key to carrying out many of these previous recommendations. As we have seen through the roundtable and IBCC process, bringing different people and groups together is not always easy but can be extremely productive. Creation of or renewal of partnerships between the CWCB and the following groups will be very important for reaching our water conservation goals:
  - Local Water Providers- Probably our most important partners in that they carry out water conservation programs to benefit their water system.
  - Intra-state government (Department of Local Affairs, Division of Water Resources, Department of Regulatory Agencies and State Facilities)
  - Green Industry (GreenCO, Irrigation Association)
  - Home Building/Construction (Home Builders Association, LEED, U.S. Green Building Council)

- Non-Governmental (Colorado WaterWise, Alliance for Water Efficiency, Western Resources Advocates, American Water Works Association, Water Research Foundation)
- Academia (Colorado State University, CU-Boulder, CU-Denver, One World One Water Center-Metropolitan State)

- **Funding**

  Stable future funding sources will be critical to enhancing water conservation activities over the near term and long term. The use of funds to implement water conservation activities statewide is a wise investment due to the fact that these are some of the most inexpensive strategies that can be implemented today and will allow local water providers to be more efficient with the water resources they already have. This is truly a no and low regret for Colorado's water supply future. Presently, the Water Efficiency Grant Program (WEGP) receives $500,000 per year through Tier 2 severance tax funds. Periodically, full funding does not appear and thus staff must be careful on how funds are spent. As Colorado water providers move forward in implementing more sophisticated and integrated water conservation programs, this grant fund will be called upon more and more. The lowest hanging fruit has been picked and if Colorado chooses to continue to use water conservation as a viable option for closing the gap, more annual WEGP funding will be required, more consistent WEGP funding will be necessary and different and varied funding will have to be created.

  Additionally, loans and grants may have to be used to bolster implementation of larger advanced metering infrastructure projects, web based customer service portals and advanced water utility billing computer systems. At present, CWCB loan funds can only be used for raw water projects with the exception of meters on potable systems. Colorado Water and Power Authority grants money from their Drinking Water Revolving fund that includes distribution rehabilitation and water meters along with scoring criteria that specifically calls out water conservation.

  Water Supply Reserve Account (WSRA) grants could also be employed to fund water conservation programming. Given the more regional aspect of some conservation programming in the past few years and the larger expenditures for more system infrastructure types of programs, WSRA funding could help fill some of the larger projects.

- **Market for conserved water**

  The use of and/or sharing of conserved water has been discussed extensively in the IBCC and state water supply planning process. The SWSI 2010 water conservation section stated that even though the section illustrated a range of potential water savings it did not necessarily translate those into closing the gap:

  > "…it did not integrate a water supply analysis, and did not attempt to discern the legal, temporal, or spatial availability of conserved water toward meeting the gap in future water supplies. The conditional forecasting methodology used for this SWSI 2010 update assumes that the identified

> strategies will be implemented and does not account for water providers' management decisions, such as storing a portion of the savings for drought or strategic planning or using a portion to improve stream flows for environmental or recreational benefits. Management decisions consider legal, temporal, economic, social, political, and spatial constraints that must be understood at a local utility level, and should be part of integrated resource planning that considers the specific water rights portfolio, system reliability, drought response, etc."

These are extremely important aspects of using conserved water to consider when addressing the water supply/demand gap. If water providers do not have the legal means to share conserved water across jurisdictions or basins then the amount applied to the gap may not be as much as could be possible. The IBCC No/Low Regrets Action Plan identified two points where more work must be done:

- Identify and, where possible, resolve legal and administrative barriers to the use of conserved water
- Identify and explore barriers to sharing conserved water

These points have much in common with allowing conserved agricultural water to be used for instream flows or using a water bank for the conserved water.

As Colorado looks to the future, water conservation will play an important role in managing our finite water resources. This section illustrates that there are a number of mechanisms and tools that can be employed to create a successful water conservation approach that diminishes the gap between supply and demand. The combination of foundational measures, incentives, regulation, education and partnerships creates a holistic approach to efficient water resource management that one or two of these approaches by themselves cannot accomplish. By creating a holistic prioritization framework, this management system can define the arena in which water efficiency can take place in the future by creating pricing incentives, monetary incentives, regulations that shape actions and education that transforms Coloradans from water customers into water stewards.

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5.6.2 Reuse

According to SWSI 2010, the reuse of existing supplies has been projected to provide 43,000 to 61,000 acre-feet per year (AFY) of water, which accounts for about 10 percent of the total Identified Projects and Processes (IPP) projected yield. The full use of reusable water supplies will play an integral role in closing the supply gap while extending the resource through efficient reuse of water.

The use of reclaimed water is controlled by Regulation 84, which was developed by the Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Commission (WQCC). This regulation currently authorizes the use of reclaimed water for landscape irrigation (including single-family residential irrigation) and various commercial and industrial uses such as cooling tower use, dust control, soil compaction, mechanized street cleaning, fire protection, and zoo operations. To achieve the goal of the protection of public health and the environment, the current Regulation specifies various approved uses, treatment and water quality requirements for specific reuse categories, conditions for use, monitoring, recordkeeping, and reporting (RMWEA/RMSAWWA Water Reuse Committee).

Colorado water law defines what water supplies can be reused, and to the extent each source can be reused. Currently there are a limited number of sources that can legally be reused in Colorado:

- **Nonnative water:** Water imported into a basin through a transbasin diversion can be reused to extinction. Transbasin diversions account for a substantial quantity of the total reusable supply in Colorado.
- **Agricultural-Municipal Water Transfers:** Agricultural transfers are generally available for reuse; however, reuse is limited to the historic consumptive use of the original agricultural water right decree. Reuse is applicable for water from traditional purchase of agricultural water rights and alternative transfer methods (ATMs).
- **Nontributary groundwater:** Reuse of nontributary groundwater is allowable.
- **Other Diverted Water:** Any water right with a decreed reuse right may be reused to the extent described in the decreed reuse right.

There are two ways in which these different source types can be reclaimed for reuse:

- **Direct Reuse:** This is the process in which the return flows from the various supplies are physically reclaimed either for potable or nonpotable uses. An example of this can be found in Aurora's Sand Creek Water Reclamation Facility for potable water or Colorado Springs Utility's non-potable water system.
- **Indirect Reuse:** This process entails the exchange or substitution of the return flows from a reusable source. The most common form of Indirect Reuse is through river exchanges, where a utility lets the reusable water flow downstream, and diverts an equal amount of water from an upstream source.

Exemplary Examples of Reuse

Currently there are 25 treaters of reuse water in Colorado. Most of these treaters are on the East slope along the Front Range. According to the IBCC's No/Low Regrets Action Plan, a few examples are:

Colorado Springs Utilities: Colorado Springs Utilities has produced reuse water for over 50 years in the form of direct reuse for irrigation and cooling. Irrigation consists of water to golf courses, parks, campuses, and other properties while cooling water is used for the cooling towers in the Drake Power Plant. According to CSU, this has yielded a savings of 1 billion gallons of drinking water per year.

Aurora Water's Prairie Waters Project: This project is an indirect potable reuse where water is pumped back 34 miles to Aurora from aquifer recharge and recovery basins in the Brighton area. Aurora picks up water from the South Platte River that it has rights to and pumps it back to the Peter Binney purification plant where it is mixed with existing water resources after treatment. The purification plant can treat up to 50 MGD.

Denver Water: Denver Water has an extensive reuse system that serves many large customers such as parks, golf courses and Denver Zoo. This system is a direct reuse system and it has a capacity of 30 MGD and is expandable up to 45 MGD.

Basin Implementation Plans

SUMMARY OF BIP WORK TO DATE IS BELOW. THIS WILL BE UPDATED BASED ON BIP WORK. ALL OF THE WORK BELOW IS IN DRAFT FROM AND IS SUBJECT TO CHANGE

Reuse of water has appeared in a couple of Basin Implementation Plan drafts. According to the *Initial Draft Statewide Basin Implementation Plan Goals* on Colorado's Water Plan website, a number of basins have created the following draft goals:

Colorado Basin-The Colorado basin is focusing on efforts that include developing water court process recommendations to encourage efficiency, conservation, and reuse.

Metro/South Platte Basin-The Metro/South Platte basin is viewing reuse water in the context of the Colorado River. Their initial goals state, "A balanced program to plan and preserve options to responsibly develop Colorado River water to benefit both east slope and west slope consumptive and nonconsumptive water uses is needed to assure that the State's plan has equal focus on the previously identified strategies including: 1) developing IPPs; 2) municipal conservation and reuse; 3) agricultural transfers and 4) new supply."

Southwest Basin-The Southwest Basin has a straight forward goal to "Support and implement water reuse strategies."

Reuse Recommendations

- **Improve quantification, planning and tracking for potential**
  At the present time, the area of reuse water in Colorado needs more research to be carried out. According to the IBCC's No/Low Regrets Action Plan, there is a lack of reliable data on how much water is currently being reused, how much potential there is and how much water is planned on being reused. More work must be done assessing how much water providers are using of their fully consumable supplies and how much more can be utilized.

As a future planning effort, regional plans and projects should be explored to utilize efficiencies in size and expenditure. Currently, the Water, Infrastructure and Supply Efficiency (WISE) partnership is underway with participation between Denver Water, Aurora Water and the South Metro Water Supply Authority. Planning for future projects such as this will be crucial to extending water supply options and increasing efficiencies in garnering those additional water supplies.

Additionally, Regulation 84 has shown to be a very flexible framework that has adapted over the years to accommodate changes and advances in the science of reuse water. Regulation 84 was created in year 2000 and has been amended four times since then to accommodate changes and new uses. As Colorado plans its reuse future, this flexibility will be paramount to adapting to new water resource challenges.

- **Research and development of additional reuse options**
  At present time, reuse water can be used for landscape irrigation, heating/cooling, vehicle washing and evaporative industrial uses. There is momentum in the near future for expanding to uses such as food crop irrigation. Locally, water providers are looking at reuse water for community garden irrigation and other such types of food crop settings. It is critical that research continue to better define the water quality needs for various reuse options to ensure treatment decisions are based on sound scientific information to facilitate the maximum benefit of reuse and efficiently invest public funds in treatment.

  On the national level as well as in Colorado, research has begun to focus towards potable reuse systems. In Colorado, most reuse systems have been non-potable in nature. Examples exist in California as well as in Big Springs, Texas where there are projects underway. Due to severe drought and serious long term water resource challenges, the Colorado River Municipal Water District (water provider for Big Springs) has undertaken the initiative of "reclaim 100% of the water, 100% of the time". Technologically, this type of system works today but more research will be needed to show reliability to assure regulators and to gain public acceptance (WateReuse Foundation, 2011). According to the Water Reuse Foundation, the Water Reuse Research Foundation and WateReuse California launched the Direct Potable Reuse Initiative (DPR) in June of 2012 to advance DPR as a water supply option in California. This was driven by the establishment in recent years of statewide goals for the use of recycled water, and a mandate from the California legislature to come up with a feasibility study by 2016 to investigate developing uniform water recycling criteria for DPR. The DPR Initiative has harnessed funding in the neighborhood of $ 6 million to carry out innovative research, such as public acceptance, critical control points, source water control, and development of an operations plan.

  Widespread development of potable reuse could be an important facet of closing the future water supply-demand gap. Additionally, CWCB has funded research into zero liquid discharge over the last few years to assess the technology needed to address the challenges created with alternative water supplies from lower quality water sources. The research will provide solutions and inform decision making related to managing membrane brine concentrate in inland areas at two pilot sites-Brighton and La Junta, Colorado (WERF, 2011).

On the smaller scale of local and site specific reuse of water, HB 13-1044 authorized the Water Quality Control Division (WQCC) to promulgate a regulation (Regulation 86) with standards for the use of graywater. Graywater is defined by the bill as wastewater collected within a building from sources other than toilets and urinals, kitchen sinks, dishwashers, and non-laundry utility sinks. Following the promulgation of Regulation 86, counties and municipalities may adopt local legislation to allow graywater use. Graywater use is limited to applications that are within the uses allowed under the well permit or water right of the original source or sources of the water. As of April 2014, the WQCC is working with the Colorado Plumbing Board to create plumbing design standards for graywater systems before developing treatment and control standards. Graywater could be an important component of new construction in the future that crosses water conservation, reuse and land use topic areas.

- **Explore incentives and funding**
  Using WSRA grant funds, future research into various areas of reuse could expand into areas such as zero liquid discharge, indirect and direct potable reuse, regional opportunities for systems and facilitating the ability to share reuse water. The CWCB Loan program could be utilized for developing some regional projects much like it was used for the WISE partnership. Additionally, State Revolving Fund loans, Title XVI Water Reclamation and Reuse Programs and Federal WaterSmart grants could be used to support more reuse development in the future.

- **Education**
  Public perception of reuse water can be a barrier to increased implementation of reuse strategies, especially involving potable reuse. Work has been done that explores how people understand drinking water reuse in the context of the urban water cycle and if this would increase acceptance of drinking water reuse projects (Macpherson, et.al, 2012). Stronger education efforts should be carried out as to the benefits of reuse water as an integral part of a water supply system and that this is a source of supply that will most likely need to be fully realized.

- **Marketing and selling of reuse water**
  According the IBCC's No/Low Regrets Action Plan, many water providers are limited in their ability to share reuse water. Incentives that better allow for reuse water to be marketed to water providers outside a service area could make building a reuse project more desirable. This could come in the form of incentivizing larger regional projects that allow for more flexible arrangements between water providers.

References:

- [Initial Draft Statewide Basin Implementation Plan Goals]. April 2014.Retrieved from http://coloradowaterplan.com/
- RMWEA/RMSAWWA Water Reuse Committee. (n.d.). [Information on web page]. Retrieved from http://www.rmwea.org/reuse/Colorado.html
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- Water Reuse Research Foundation (2012). Effect of Prior Knowledge of Unplanned Potable Reuse on the Acceptance of Planned Potable Reuse; Macpherson, Snyder, Law and Johnson.
- Water Reuse Research Foundation and WateReuse California (2011). Direct Potable Reuse: A Path Forward; Tchobanoglous, Leverenz, Nellor, Crook.

5.6.3 Land Use

As Colorado grows in the future, land use planning and water planning will become more closely connected through integration of principles from both disciplines. This does not mean that local control over these two planning spheres will be diluted. The way a local municipality, county or some other local government chooses to develop will remain intact. Private property rights, 1041 powers and local control will not be diminished by the connections between these planning disciplines. Rather, local growth and water supply planning could be enhanced through the development of best practices, financial incentives and other technical resources.

Higher density development has been shown to save water over traditional developments along with many other benefits. The 2009 California Water Plan Update showed that a 20% increase in density could yield a 10% water savings (California Water Plan, 2009). Different land use and development patterns extend beyond just density, bringing in a host of elements that help define what a community looks like such as transportation, open space, community design and walkability. There are also synergies to be gained between density and landscape and irrigation best practices. The landscape and irrigation layers fit within densification to offer more benefits within a denser land use environment than if they were employed within a traditional less dense environment. This does not mean that urban landscapes will disappear with a denser environment. Healthy urban landscapes tremendously enhance the livability of a city or town and are a crucial asset for urban populations.

Denver Regional Council of Governments Water Conservation Vision, Goal, and Policies

Vision: The Denver metro region will maximize the wise use of limited water resources through efficient land development and other strategies, recognizing that no single strategy will meet the state's water needs and the region will need to pursue a range of strategies concurrently.

Goal: Reduce regional per capita municipal and industrial water use by working with municipalities, counties, water providers and other stakeholders within the next 6 to 12 months (February 2012) to identify a specific numeric target or measurable benchmark against which to measure progress.

Policies

1. Regional Collaboration. DRCOG will bring together local governments, water providers and other stakeholders to facilitate collaborative efforts to promote water conservation.

2. Best Practices. DRCOG will work to increase understanding of the link between land development and water demand, and to identify best practices for promoting the efficient use of water resources across the region.

3. Efficient Land Development. Compact development, infill and redevelopment consistent with DRCOG's urban growth boundary/area and urban centers policies will help reduce water demand and related infrastructure costs.

Source: DRCOG MetroVision 2035:34

Another recent concept that is gaining support in Colorado is the idea of "Net Zero Water Developments". The concept states that there are certain management practices that can be developed for a site that will reduce the water quantity and quality impacts. The concept can span scales from a building site to a more regional scale and has the goal of becoming water neutral. Net Zero Water is being forwarded by the Colorado Water Innovation Cluster and a large stakeholder group where a toolkit and set of guidelines are being developed for Colorado.

The manner by which Colorado develops into the future will have a strong bearing on Colorado's future water supply gap and vice versa. The CWCB began preliminary work in this arena in 2009 by hosting the *Water and Land Use Planning for a Sustainable Future* conference and creating an associated report and density memo describing several actions that bridge the land and water topic areas. Recently, urban land use has been a major discussion point at the Interbasin Compact Committee where they incorporated several options into the Water Conservation No and Low Regrets Action Plan. Some of these appear below in the recommendations sections.

Additionally, a recent collaborative effort involving water planners and land use planners from local jurisdictions showed promise in moving the dialogue forward. The Land Use Leadership Alliance (LULA) convened land use and water planners along with city managers, city council members, developers, regional government planning groups and CWCB staff for four all day sessions focusing on the land use and water planning nexus. These sessions proved very productive at not only developing strategies for better integration of land and water planning but also assisting in the development of relationships between land and water planners within municipalities and between the different municipalities who were present (LULA, 2013). This could be a model for connecting local planning efforts together within a local government as well as into regional planning efforts.

Finally, the Denver Regional Council of Governments (DRCOG) has also been exploring the nexus between water use and land use patterns in recent years. The latest Metro Vision 2035 document was adopted in 2011 and for the first time includes a water conservation section that ties into land use planning. DRCOG has a goal of increasing housing density by 10% between year 2000 and year 2035. According to the CWCB density memo *Calculating Per Capita Water Demand Savings from Density Increases to Residential Housing for Portfolios and Trade-Off Tool*, this 10% would equal approximately a 5% decrease in water use in this housing sector (CWCB, 2010).

Recent Legislative Actions

House Bill 08-1141 required that building permit applications for developments of more than 50 single-family equivalents include specific evidence of an adequate water supply. An adequate supply is defined as one that sufficient for the development through buildout in terms of quality, quantity and dependability. The developers must submit proof of adequate supply to the local government through a report from a professional engineer or water supply expert that identifies the water source and what kinds of demand management will take place on the site. An update to House Bill 08-1141 occurred through Senate Bill 13-258. Through House Bill 08-1141, a local government was permitted to make the adequacy determination only once during the development permit approval process. Senate Bill 13-258 modified the definition of the term "development permit" to clarify that each application included in the definition constitutes a stage in the development permit approval process.

Potential Land Use Recommendations

RECOMMENDATIONS WILL BE UPDATED BASED ON BIP WORK.

As mentioned previously, in 2010, CWCB produced a report titled Colorado Review: Water Management and Land Use Planning Integration. Several local actions that could be used more broadly stemmed out of that report. These local governmental and utility tools could be very effective in shaping how water is used in the future and are consistent with the IBCC No/Low

Regrets Action Plan that focuses on incentives as much as possible. Some of these potential recommendations for further exploration include: expedited permitting for buildings and developments that incorporate certain water efficiency measures or high levels of density; tax incentives: developments that incorporate certain water efficiency measures or high levels density; structures impact (tap) fees that are designed to promote water-wise developments and in-fill; and water budget rate structures to help maintain initial projected water budgets for each site.

Other recommendations for the Water Management and Land Use Planning Integration report that could be considered include partnerships and funding opportunities. These are described below.

Partnerships: To be successful in land use, it will be necessary to partner with many different agencies and groups. Much like water conservation and other water issues a necessary first step is bringing people together. Possible partnerships:

- Local Municipalities/Local Water Providers- The rubber meets the road at this level. These are the entities that will actually carry out these plans. Without their partnership and support of new ideas, an idea like comprehensive water/land planning will not succeed.
- Department of Local Affairs- DOLA carries out much work in the land use and local government arena. Like the CWCB, they also have grant funding that could be leveraged for water-land use projects.
- Department of Regulatory Agencies- DORA regulates professionals in various industries and works to create a fair marketplace. They could be partnered with regarding the landscape and irrigation industry or the property management industry and their connections to water demand.
- Home Building/Construction (Home Builders Association, LEED, U.S. Greenbuilding Council
- Non-Governmental (Keystone Center, Alliance for Water Efficiency, Western Resources Advocates, American Planning Association)
- Academia (Colorado State University, CU-Boulder, CU-Denver, One World One Water Center-Metropolitan State)
- Land Use Leadership Alliance- This organization brings an innovative training model that could change the way Colorado looks at this subject.
- Council of Governments- These entities are extremely important at making the connection between local and state level. A crucial link between scales.

Funding: As with many other aspects of Colorado's water plan, funding will have to be an integral part of any initiative moving forward.

- Water Efficiency Grant Program and Water Supply Reserve Account grant funds could be used for funding aspects of the land use and water planning nexus. For example, WEGP funds could be used to implement inclusion of demand management strategies in local comprehensive plans. This has been identified as an important step for integration of water demand and land use planning. Additionally, WEGP funds could be used to study land use patterns to ascertain possible demand reductions associated with certain land use patterns. WSRA funds could be used for larger regional efforts as they tie more directly into the Basin Roundtables and larger regional projects.

Lastly, the Land Use Leadership Alliance has suggested further education and training on a longer-term basis to help create a long lasting culture of collaboration between land use and water supply/demand planning. This would be a necessary first step to integrating land use and water supply/demand planning on a broader scale.

References:

- California Water Plan Update. Department of Water Resources. 2009. Integrated Water Management Bulletin 160-09.
- Calculating Per Capita Water Demand Savings from Density Increases to Residential Housing for Portfolio and Trade-Off Tool. 2010. CWCB. Draft Technical memorandum.
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- Metro Vision 2035 Plan. Denver Regional Council of Governments. 2011.
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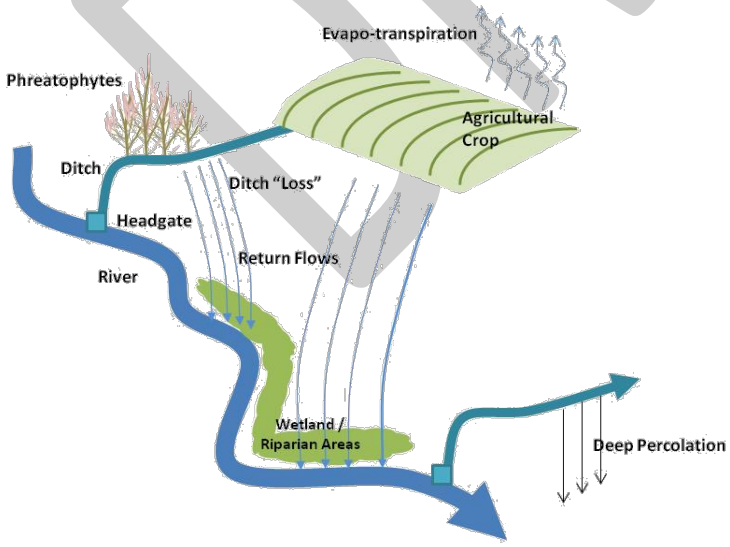
- Land Use Leadership Alliance. 2013. Retrieved from http://www.law.pace.edu/land-use-leadership-alliance-training-program

5.6.4 Agricultural Conservation, Efficiency, and Reuse

Background

Despite the fact that agriculture uses the large majority of water in Colorado, there are only limited opportunities for agricultural conservation, efficiency, and reuse. The primary underlying reason for this is that the majority of agriculture in Colorado operates in a water deficit. If provided more water, most acres in the state would use it, which means that efficiencies often lead to increased use of water rather than a decreased use. In addition, water law in Colorado limits how agricultural conservation, efficiency, and reuse water can be utilized. This subsection will describe the opportunities and limitations.

Agricultural water conservation, efficiency, and reuse are broad topics that encompasses several characteristics that need further clarification, depending on the scale and context agricultural conservation is approached. Some issues need to be approached from the river basin scale; and others from a more site-specific, individual farm scale. The context in which agricultural conservation is examined must also be understood for both the basin and site-specific scales. While there is to some degree a perception that any water "conserved" by agricultural use can be transferred to other uses, it is vital to consider the physical, legal, and institutional context of agricultural conservation in order to determine if any of this water can be used for other purposes. Agricultural producers across Colorado are working to improve efficiencies, and reduce consumptive use for various reasons ranging from needed selenium and salinity water quality improvements to complying with interstate compacts or Supreme Court rulings.. The Rio Grande and Republican River basins are working to maintain a sustainable agricultural community in the face of an imbalance between available water supplies and current levels of water use. The South Platte is grappling with a Supreme Court decision that led to the shutdown of many agricultural producers who relied on tributary groundwater wells. For this and other reasons, many agricultural producers have implemented extensive augmentation plans that allow the South Platte to operate very effectively on a basin-wide scale. Similarly, the Arkansas has struggled with a Supreme Court Ruling related to the Arkansas River Compact. Recent work in the Uncompahgre Valley serves as an excellent example of agricultural efficiencies. For instance, a water users association converted portions of its open-ditch delivery system to pipelines. In the Grand Valley near Grand Junction, many of the headgates were modernized to support the endangered fish species in the Colorado River, and many of the



5.6.4 Figure 1: Agricultural Interactions

orchards are now on drip irrigation. CWCB and others have provided grants and loans to many agricultural producers across the state to improve agricultural conservation, efficiency, and reuse.

However, agricultural water use is deeply connected throughout each basin. The runoff, also known as return flows, of one farm serves as the water supply for the next, as depicted in the figure below. Changes in the timing and amount of the return flows can mean that that downstream agricultural producer doesn't get enough water when it is needed to have a successful crop. This is called "injury," and is illegal in Colorado. Because changes in how one farm operates can ripple up and down the basin, caution must be taken prior to making too many changes too rapidly.

Furthermore, in many cases, agricultural use benefits late summer flows, as well as riparian and wetland areas, which in turn benefit fish, migratory birds and many other species in Colorado. Photos and anecdotal accounts from the eighteen hundreds on the Yampa River, for instance, indicate that many of Colorado's rivers and streams essentially dried up in the late summer and early fall months. The cottonwood canopy and other riparian plant communities did not exist in abundance prior to irrigated agriculture. When agricultural water is applied to the land, the system operates like a giant sponge, slowly releasing water back into the river system over time. This can take hours, months, or years depending on how far and through what type of substrate the water travels. The effect of this retiming means that many of the rivers and streams now have water during the hottest time of the year, which is the most stressful for fish. It also means that riparian and wetland areas adjacent to the stream get water. For instance, there is a large and critically important wetland complex on the western side of John Martin Reservoir in the Arkansas, that is critical to endangered bird species, the Least Tern and Piping Plover. This wetland complex would not exist to such an extent without agricultural production retiming this water. Balancing river and riparian needs during the time of diversion compared to the benefits of being retimed through return flows requires careful consideration prior to making too many agricultural lands highly efficient.

State of Knowledge on Agricultural Reuse

Typically agricultural water is not "fully consumable" so it cannot be reused on a specific farm. However, within each basin the same water is used over and over again. At this basin scale, repetitive uses of water within a basin are achieved by the occurrence of return flows. Return flows occur as a result of agricultural water diversions, deliveries and irrigation applications. Downstream appropriators depend upon upstream return flows generated by either municipal and industrial uses, or agricultural uses. Each successive diversion generates potential return flows for beneficial use by downstream appropriators, and this system of use and re-use allows for multiple uses of water within basin systems and generates an increase in water supplies for downstream users in the latter part of the irrigation season. It has been estimated that in some basins water may be used as many as seven times before it crosses the state line.

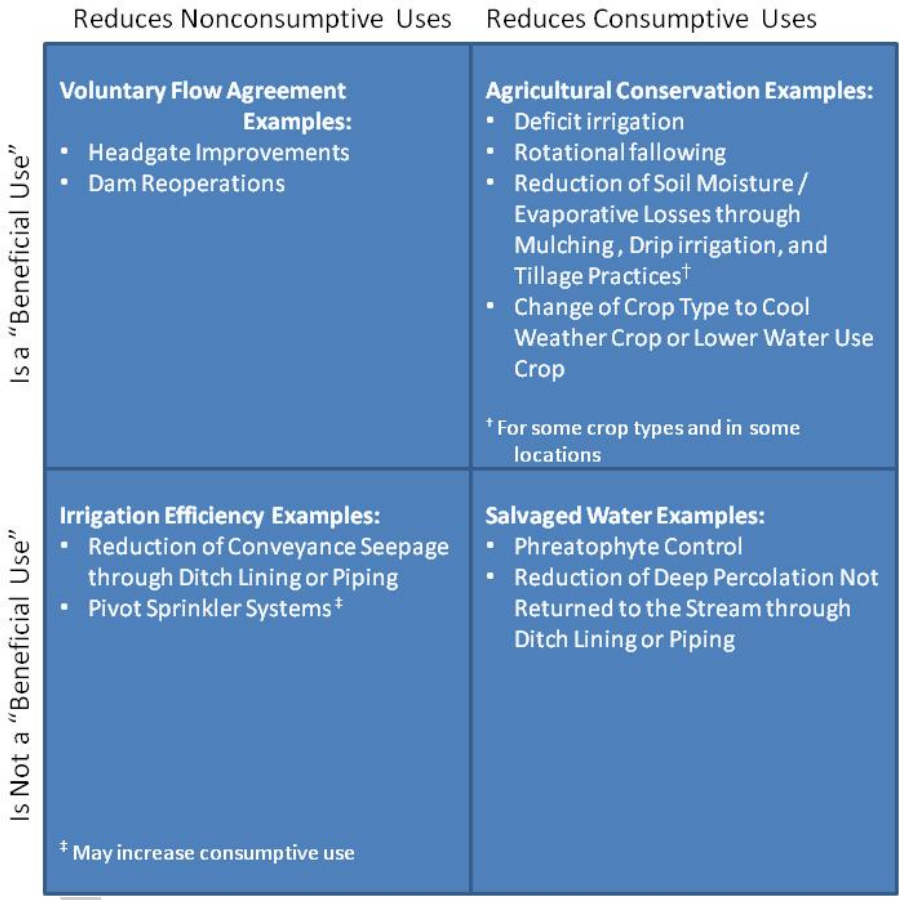
In addition, there are more and more examples of agriculture directly reusing municipal water supplies. For instance, Colorado Springs and Pueblo lease fully consumable reuse water to agricultural producers downstream of their wastewater treatment plants. However, as

municipalities begin to grow into their reusable supplies, it could negatively impact agricultural production.

Reuse is more fully explored in subsection 5.6.2.

State of Knowledge on Agricultural Conservation and Efficiency

As depicted in Figure 1, there are many agricultural interactions and uses, and this is reflected in the types of agricultural conservation and efficiency. Essentially there are two major concepts that need to be clarified. The first is whether or not a use is "consumptive" or not. If it is consumptive, then reducing the consumption of water may yield useable water that could be used by another user. However, there may be legal limitations to doing this. The other concept is whether the water can be used as a "beneficial use" or not. If it can be used as a "beneficial use" then it can have a water right associated with it. Figure 2 provides a few examples for how to describe these different types of agricultural conservation and efficiency. Agricultural conservation and efficiency measures have the potential to alter return flows which in turn have the potential to alter basin hydrology, thus impacting our ability to meet interstate obligations or the needs of downstream users.



5.6.4 Figure 2: Different types of agricultural conservation and efficiency

The four types of agricultural conservation and efficiency are described below.

Irrigation Efficiency is generally viewed as water that results from more efficient diversion and application methods. These irrigation efficiency measures may include irrigation delivery system improvements and irrigation application methods that reduce ditch seepage and return flows generated by field application of irrigation water. It should be noted that some of these measures have the potential to increase the crop beneficial consumptive use of the agricultural

activity by improving the application efficiency. Typically, water supply is plentiful early in the irrigation year, hence crop consumptive use (CU) is not limited and is equal to the crop Irrigation Water Requirement (IWR). As the irrigation season continues, the available water supply generally decreases, becoming insufficient to satisfy crops' IWR, therefore CU is limited by supply. Hence as irrigation application efficiency improves, the crops' ability to consumptively use (CU) irrigation water increases.

Salvaged Water is generally viewed as water that results from reducing non-beneficial consumptive use of water, such as by the elimination of phreatophytes or by the reduction of deep percolation of water which does not return to the system as surface or groundwater return flows. Elimination of non-beneficial consumptive use can be accomplished by instituting irrigation efficiency measures.

Conserved Water refers to water that is part of the beneficial consumptive use of a water right that is removed from an irrigated cropping system by reducing the consumptive use of the agricultural activity. Measures that can generate conserved water include: deficit irrigation; rotational fallowing; reduction in irrigated acres; conversion to cool weather crops; conversion to crops with a shorter growing season; reduction in evaporative losses from the field surface by introducing conservation tillage practices, mulching, and drip irrigation. As with water resulting from irrigation efficiency measures, Conserved Water has the potential to alter return flows and must be considered on a system wide basis. The transfer of this water, while possible under Colorado water law, has not yet been tested in water court or codified by the legislature.

Voluntary Flow Agreements can be conceived that involve the re-operation of dam releases and headgate improvements that provide stream flows that benefit nonconsumptive uses. For example, the Arkansas River Voluntary Flow Management Program is a cooperative effort among the Colorado Department of Natural Resources, Colorado Parks and Wildlife, Colorado Trout Unlimited, the Southeastern Colorado Water Conservancy District and the Arkansas River Outfitters Association, and is assisted by the United States Bureau of Reclamation. The purpose of the agreement is to provide flows that benefit the mutual goals of divergent groups of water owners, water providers, water users, municipalities and government agencies.

Under current Colorado water law the amount of water that is legally transferable is an irrigator's historical consumptive use, not the amount of water diverted. In addition, with any transfer the historical return flows must be maintained at the same location, timing, quantity and rate of flow in order to avoid injury to downstream appropriators (or any other water rights holder) who are entitled to the stream conditions that existed at the time of their appropriation. The historical consumptive use is determined by the amount of water removed from the river system by crop evapotranspiration as well as deep percolation losses to nontributary groundwater aquifers. Furthermore, consumptive use can be defined as a water use that permanently withdraws water from its source; and water that is no longer available because it has: evaporated, been transpired by plants; incorporated into products or crops; consumed by people or livestock; undergone deep percolation and is not returned to stream; or otherwise removed from the immediate water environment.

As such, water that results from more efficient diversion and application methods can only be used on lands for which the appropriation was originally made. Selling or delivering (transferring) this type of water to other uses or new lands could constitute an improper expansion of use under current Colorado water law.

Moreover, Salvaged Water is water in the river or its tributaries which would normally go to waste, but somehow is made available for beneficial use. However, when salvaged waters are made available, they belong to the river system in general and are subject to call by senior appropriators in order of priority. Put more plainly, an appropriator that salvages water, whether by eliminating phreatophytes or by any other means, does not have a right to use that water outside of the priority system, and therefore does not have the potential to transfer salvaged water to any other use.

The transfer of Conserved Water, generated by a reduction in beneficial consumptive use, while possible under Colorado water law, has not yet been tested in water court or codified by the legislature. Conserved water generated by one of several approaches, such as; deficit irrigation; rotational fallowing; or a transition to cool season crops, is the subject of Alternative Agricultural To-Urban Transfer Methods and will be further explored in Section 5.7 of Colorado's Water Plan.

Increased agricultural conservation could potentially result in a voluntary reduction in the diversion of water to the farm, creating benefits such as improved water quality, and allowing water to remain in the streams that can provide environmental benefits.

Basin Implementation Plans

For 2014, each Basin Roundtable is formulating their own implementation plan, and several include agricultural water conservation and efficiency goals and activities.

SUMMARY OF BIP WORK TO DATE IS BELOW. THIS WILL BE UPDATED BASED ON BIP WORK. ALL OF THE WORK BELOW IS IN DRAFT FROM AND IS SUBJECT TO CHANGE

Initial drafts of the Basin Implementation Plan goals for most of the roundtables indicate that they plan on increasing efficiencies and modernizing agricultural infrastructure. Several examples of these are below:

- Arkansas Roundtable: Provide increasing quantities of augmentation water for increased farm efficiencies.
- Colorado Roundtable: Improve agricultural efficiency, preservation, and conservation.
- Gunnison Roundtable: Restore, maintain, and modernize critical water infrastructure, including hydropower.
- North Platte Roundtable: "Continue to restore, maintain, and modernize critical water infrastructure to preserve current uses and increase efficiencies."
- Rio Grande Roundtable: Operate, maintain, rehabilitate, and create necessary infrastructure to the Basin's long-term water needs, including storage.
- Southwest Roundtable: developed a draft goal to "Implement efficiency measures to maximize beneficial use and production.
- Yampa/White/Green Roundtable: Restore, maintain, and modernize water storage and distribution infrastructure.

Interbasin Compact Committee (IBCC) Actions

As part of the IBCC's ongoing work, the IBCC is recommending that "Colorado will continue its commitment to improve conservation and reuse." As part of this draft work, recommendations for agricultural conservation and efficiency improvements for current and future agriculture were developed. This is incorporated into the recommendations below.

Recent and Past Legislative Actions

There are some existing legislative exceptions to the aforementioned limitations which are applicable in narrow instances, such as:

HB 05-133 stated that an owner would not abandon their water right if certain conditions were met. Two conditions refer to "a water conservation program approved by a state agency and a water banking program as provided by law". These don't go as far as allowing sharing but it does state that an owner of a water right won't lose the right if non-use stems from water conservation activities.

HB 13-1130 allows a water right owner with an interruptible water supply agreement (IWSA) to request up to two additional ten-year periods for the IWSA. IWSAs enable water users to transfer a portion of their water right, called the historical consumptive use, to another water user on a temporary basis, without permanently changing the water right.

SB 13-019 restricts a water judge from determining a water user's historical consumptive use based on water use reductions resulting from the enrollment in a federal land conservation program; participation in certain water conservation programs; participation in an approved land fallowing program or to provide water for compact compliance; or participation in a water banking program. Some water users may wish to reduce their water consumption in order to limit the effects of drought on stream flows. However, under current law there is a disincentive that penalizes appropriators who decrease their consumptive use of water.

This section will be updated pending any changes to the law in the future.

Agricultural Conservation, Efficiency, and Reuse Potential Recommendations

RECOMMENDATIONS WILL BE UPDATED BASED ON BIP WORK.

The following points related to the implementation of agricultural conservation and efficiency measures are presented as a starting point for further discussion.

1. Incentives for on-farm implementation of agricultural conservation measures could be considered and evaluated at the appropriate scale and within the appropriate physical, legal and institutional context (based on CAWA 2008).
2. Many of the Basin Implementation Plans are looking to find the explicit interconnections between agriculture and nonconsumptive uses. In addition, several are looking to decrease agricultural shortages. As part of this work, each basin should seek to reduce non-beneficial consumptive use by following the guidelines laid out in the CAWA 2008 agricultural conservation paper, which include reducing soil moisture loss where practical through drip irrigation or mulching (CWCB 2014).

3. Lining of high-priority ditches is another important tool in reducing seepage losses, and should be encouraged in appropriate areas (CWCB 2014).
4. Phreatophyte control presents one of the largest opportunities for reducing non-beneficial consumptive use and should be pursued aggressively, although balancing this with nonconsumptive needs can be challenging (CWCB 2014). Incentives for landowner control of phreatophytes, given savaged water limitations, could be developed (CAWA 2008)

5. To create incentives for implementing agricultural conservation measures, the cost of these measures could be borne by the beneficiaries of the re-purposed water. The agricultural user is unlikely and/or unable to bear the costs if benefits only accrue to improved stream flows, water quality, or the basin as a whole (CAWA 2008).
6. Additional incentives should be developed to assist basins in implementing, where appropriate, agricultural efficiency and conservation practices, support the ecosystem services agriculture can provide, and changing crops type to a lower water use crop (CWCB 2014).
7. New agricultural lands (currently identified in the North Platte and Yampa basins) should be designed to wither use best management practices with regard to agricultural conservation and efficiency, or, alternately, be measurably and explicitly multi-purpose by meeting identified nonconsumptive needs (CWCB 2014).
8. The state will need to develop administrative means to track and allocate conserved water and ensure compliance (CAWA 2008).
9. Irrigation water conservation demonstration and pilot projects in each basin should be encouraged (based on CAWA 2008).
10. Projects and Methods that support agricultural efficiency, modernization and conservation presented in Basin Implementation Plan recommendations should be supported.

In summary, while potential opportunities for transferring agricultural water to other uses may exist, they are somewhat limited. The scale and context of agricultural conservation must be account for when considering implementation measures and policy proposals. Although currently available technologies and practices could generate water that could be put to other beneficial uses, our physical, legal and institutional framework place certain constraints on what is currently possible.

References:

- Caile, Bill and Anne Castle (July 2007). *Salvaged Water – Memorandum to the South Platte River Task Force.*
- CDM (2010). *Draft Technical Memo: State of Colorado Current and 2050 Agricultural Demands*
- Colorado Agricultural Water Alliance (September 2008). *Opportunities and Challenges Associated with Potential Agricultural Water Conservation Measures.*
- Colorado Division of Water Resources (2011). *Synopsis of Colorado Water Law*.
- Colorado Water Conservation Board (CWCB) (January 2011). *Statewide Water Supply Initiative 2010.*
- Colorado Water Conservation Board (CWCB) (June 2013). *Alternatives to Permanent Dry Up of Formerly Irrigated Lands.*
- Colorado Water Conservation Board (CWCB) (April 2014). *Draft IBCC Discussion Document for a Conceptual Agreement*.
- Colorado Water Institute, Colorado State University (undated Power Point presentation). *Opportunities and Limitations for Agricultural Water Conservation in Colorado*.
- Colorado Water Resources Research Center, Colorado State University (October 1996). *Irrigation Water Conservation: Opportunities and Limitations in Colorado – A Report of the Agricultural Water Conservation Task Force, Completion Report No. 190.*
- Partners for Western Conservation (undated brochure). *Finding Common Ground on Water*.

5.6.5 Self Supplied Industrial Conservation and Reuse. STILL IN PROGRESS. OUTLINE INCLUDED BELOW.

Potential Approach

Summarize efforts to partner with industry, including the water savings associated with utilization of natural gas and renewable energy sources. This section could be focused on the energy/water nexus more generally and describe recent energy/water nexus efforts.

Initial Outline

Introduction

- What SSI means: Industrial uses that have developed their own independent waters supplies (e.g., beer, snow making, power plants, mining, etc.)
- Colorado's SSI uses a small proportion of water from the statewide perspective, but is significant in local areas.
- Major water users within the category are for thermal electric power generation and energy extraction.
- In addition, many water uses tap energy resources
- The focus of the section will be on the water energy nexus.

"The water-energy nexus is a term used to describe the interaction and interdependencies between water and energy resources. Understanding the dependencies, synergies, conflicts, and trade-offs between these two critical resources is necessary to identify and implement mutually beneficial strategies for their management and use (AWE, 2013)"

Water footprint of energy development (Primarily Refers to Chapter 3)

- Current Water Demands for extraction and production
    - Shoshone and Powell as examples of roles that energy plays in water administration.
    - Xcel uses a total about 30,000 acre feet of consumptive water (Expert Energy Discussion, 2014) and it is estimated that statewide there is between 60-65,000 acre feet of total consumption (WRA, 2013)
    - Will incorporate aspects of the 2013 State Drought Plan from Annex B Chapter 7 Energy Sector
- Potential Future Water Demands (extraction)
    - Oil Shale – Could be a large amount of water
    - Natural Gas – smaller but still significant
    - Coal – mostly continue at rather low levels of water use
    - Uranium – minimal
    - Renewables (minimal)
    - *Chapter will utilize a figure comparing water use of different energy extraction practices*
- Potential future water demands (production) – This is shifting towards natural gas and various renewable energy sources, which will reduce water on the production side.
    - Energy demand is likely going to go up, but because of increasing role of renewables and natural gas along with efficiencies, water use may be keeping steady overall. CWCB is

currently interviewing energy utilities about this. Utility plans for the next couple of decades indicate that greenhouse gas emissions are likely going downward because of natural gas and renewable use. Water use may follow this trend. At the State level, government has already moved to support less water dependent power generation with the 30% renewable by 2020 mandate.

- Add discussion about different cooling techniques. Colorado energy companies use cycle flow techniques, so this is already more efficient that the open flow techniques used in the Midwest and Northeast (Expert Energy Discussion, 2014). In addition, several plants use a hybrid cooled approach, when some of it is cooled by air, until air temperature gets to be about 80%. 100% dry cooling takes significant financial costs and more fuel is needed, so there are increase emissions. Still some new power plants may focus on dry cooling.
- Xcel is not trying to develop future base water supplies at this time and not have control over issues water use has been flat and will remain flat.

Energy footprint of water development

- Current
- Potential Future (include reuse/advanced treatment, groundwater pumping, potential large pipelines)

Domestic Water/Energy Nexus

According to the Alliance for Water Efficiency (AWE 2013), half of the water/energy nexus is defined as "E-W or Energy for Water or the half of the water-energy nexus referring to the energy required for water conveyance, water treatment, water distribution, and wastewater treatment."

The 2009 study, *Water Conservation = Energy Conservation: A Report for the CWCB* stated that, "Energy is embedded in water. Water utilities use energy to pump groundwater, move surface water supplies, treat raw water to potable standards, and distribute it to their customers. Customers use energy to heat, cool, and pressurize water; and wastewater treatment plants use energy to treat wastewater before discharging it (Figure 1)."

Figure 1. Energy is used to pump, treat, distribute, and use potable water, and to treat wastewater. Graphic: Cohen, R., B. Nelson, and G. Wolff, 2004. *Energy Down the Drain: The Hidden Costs of California's Water Supply.* Natural Resources Defense Council and Pacific Institute.

The area where energy and water meet in domestic water is centered around water conservation measures that can be employed to lessen the energy intensity. Water supplies carry vastly different energy intensities depending on where they originate and how they are conveyed. Some water supplies are almost purely conveyed using gravity while other supplies are very energy intensive requiring a large amount of electricity to pump water from deep underground.

Water conservation and energy efficiency can play synergistic roles in lessening the impacts of the other. Through more efficient changes in treatment, distribution and end uses in water use, energy use can be made more efficient and vice versa. This can extend back to saving energy in the Self Supplied Industrial realm of energy production thus saving water that would normally go into the process of producing this energy.

Next Steps:

Potential next steps will draw from the 2013 Water/Energy Nexus Workshops, discussions with energy experts, basin implementation plans, and the Colorado State Drought Plan.

References:

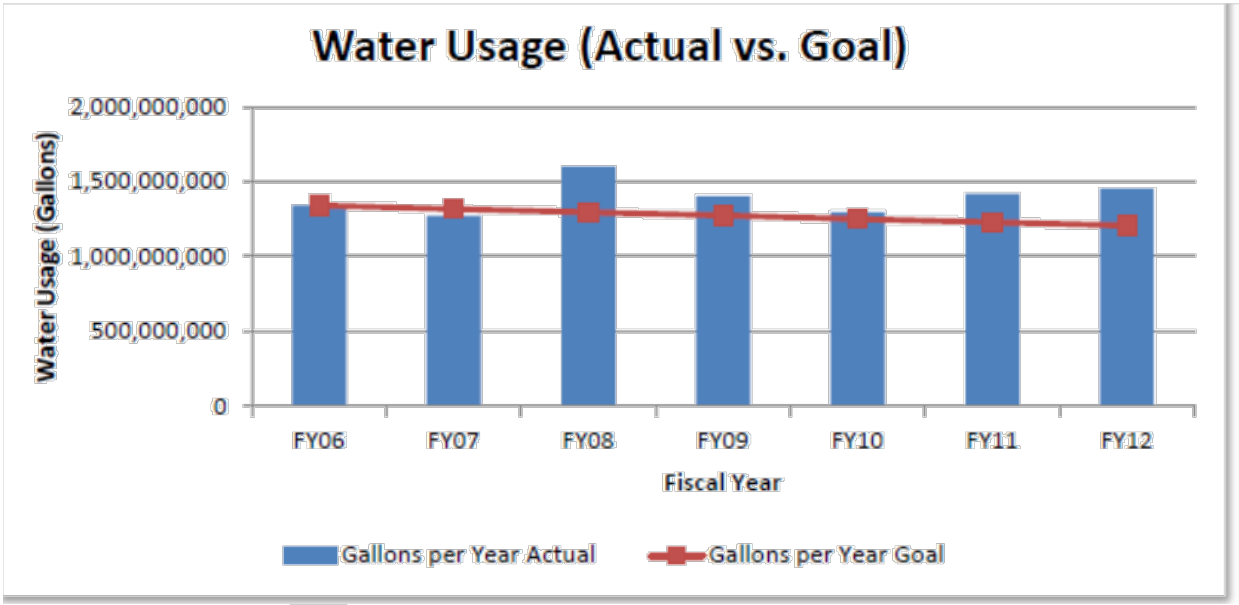
- Alliance for Water Efficiency/American Council for an Energy Efficient Economy (AWE 2013).
- Water-Energy Nexus Research: Recommendations for Future Opportunities.
- Western Resource Advocates (WRA 2009). Water Conservation = Energy Conservation
- 2014 discussion with energy experts (Colorado Energy Office, Xcel Energy, Western Resource Advocates)

5.6.6 State Agency Conservation

The Colorado Energy Office has been facilitating a Greening Government initiative since Governor Bill Ritter issued Executive Order D 0012 07. The following is taken from the 2012 Greening Government Annual Report Card (Colorado Energy Office, 2012). The Executive Order mandated State agencies to reduce water consumption by 10% by FY 2012 over the baseline usage of FY 2006(Executive Order D 0012 07). State agencies have reduced their water consumption by various methods such as installation of efficient plumbing fixtures, advanced lawn irrigation controls and taking advantage of re-use water.

The State has seen an increase of 8.4% (112.5 million gallons of water) in water use. The following data was provided by each agency individually and reflects their best attempt to record all water purchases between FY'06-FY'12 in EnergyCAP. ***Water usage has not been normalized for the increase in state employees, increasingly hot weather, or new water-intensive industries.***

Of the 14 agencies and departments with owned square footage, six reduced their water use by more than 10%, four reduced their water use by less than 10%, and four increased their water use.



Exemplary State Agency Projects

- Colorado Department of Health and Environment has decreased its water use by 11% since 2005. They replaced 2 acres of bluegrass lawn with xeric grass species which is saving over 2.5 million gallons per year. They also replaced high flushing urinals with .5 gallons per flush urinals and also installed waterless urinals.
- Capitol Complex facilities personnel have conducted some notable efforts over the last few years. They worked with Denver Water to audit all cooling towers for the Capitol Complex and can reduce consumption by almost 500,000 gallons per year. They can also now take

advantage of Denver Water incentives. Another example that is not captured in this annual report is a landscape transformation initiative that is taking place on the Capitol grounds. A collaborative group from the Governor's Office, CWCB, Denver Water, the Denver Botanic Gardens, Colorado Nursery and Greenhouse Association and Capitol Complex Facilities is working on plans to reduce water consumption and demonstrate the benefits of water wise landscaping on the Capitol building grounds. This high profile project will highlight to the public what can be done with Colorado appropriate landscapes.

Recommendations from Annual Report Card

- Continue requiring water reductions by all state agencies.
- Require agencies to take advantage of free or reduced cost water audits by their water utility, if applicable.
- Look into bulk purchasing of water efficient appliances for state agencies.
- Continue educating Council about the Energy/Water Nexus
- Research and identify alternative ways to provide sufficient funding for water efficiency.
- Continue encouraging agencies to use their water rights.

This water use is an important standard to strive for in that the State should lead by example in its own facility water use. This idea ties back to the philosophy of the SWSI Levels Framework where water providers should prioritize their foundational activities first and then focus on what they have direct control over within their own facilities. While much has been done at state facilities, better tracking and quantification could take place to normalize the data for weather, number of employees and any new intensive uses that have come online.

References:

- Colorado Energy Office.2012. Greening Government Annual Report Card. Retrieved from http://www.colorado.gov/energy/
- Executive Order D 0012 07 (2007)