Date Submitted
Jan 20, 2012

Option Name
Municipal Efficiency: 1% per Year

Description
For the past two decades, per capita water use has decreased at an average of 1% per year across the Colorado River Basin.[1] Given the increasing costs of water for customers, improvements in water efficiency technologies, increasingly stringent regulations of water use and waste, and utility campaigns to increase awareness about the value of water, replace turf with climate-appropriate vegetation, and a growing commitment to financially support water efficiency and conservation programs, this trend will continue into the future.

This Option does not require any specific action; rather it assumes that historic and recent actions will continue, and will be adopted by more agencies, as the cost of water continues to rise and its availability continues to decline.

Location
Basin-wide for all municipal demands.

Quantity & Timing
The quantity of water can be determined by comparing basin-wide 2060 municipal water demands under a no-option case to 2060 demands with the 1% per Year option in place. To calculate the 1% per Year option, for each planning area, simply reduce the "Scenario A" 2015 per capita demand by 5% (a 1% reduction for five years, assuming that the submitted data accurately reflects 2010 per capita demand; adjust accordingly if submitted data reflects data from an earlier/later year). Decrease this new 2015 per capita demand by 20% (a 1% reduction for 20 years) to generate 2035 per capita demand, and reduce the new 2015 per capita demand by 45% to get the 2060 per capita demand.

The timing for this strategy is implicit in the methodology – gradual, but consistent decreases in water demand through time.

Technical Feasibility
The water efficiency "tool-box" is immense, growing every day, and easily tailored to individual municipal water providers. Please see the attached, non-comprehensive list of individual water efficiency measures that could be implemented to achieve a 1% per Year reduction in per capita use. Respected water conservation experts state that current overall municipal demand can be reduced by up to 50%.[2,3]

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[1] Pacific Institute. 2011. Municipal Deliveries of Colorado River Basin Water. June.

[2] DeOreo, W. 2007. How much water conservation should be in your water supply portfolio? Presentation at 2007 Regional Water Symposium, August 29-September 1, 2007, Tucson, AZ.

Costs

Variable, depending on the type of efficiency measures implemented, some costing information is discussed in the attached. Multiple studies suggest water efficiency is the cheapest "new" water supply available to municipal providers. In Colorado, for example, efficiency costs $5,000 to $8,000/acre-foot, while traditional water supply development projects range from $12,000 to 30,000 per acre-foot.[4,5]

Permitting

No federal or state permitting requirements.

Legal/Public Policy Considerations

Some practices may require local, state, or federal ordinances/codes that necessitate approval by the appropriate level of government.

Implementation Risk/Uncertainty

Improving municipal efficiency carries little to zero risk. Managing existing supplies more efficiently is a no-regrets solution.

Reliability

Improving urban water efficiency through the long-term implementation of water saving practices and technologies results in a permanent reduction in per capita water usage. One long-asserted claim is that long-term conservation can reduce the water savings potential during water shortages. According to the so-called "demand-hardening" argument, today's non-essential water uses provide a cushion in the system that can be eliminated during dry years as a drought-response measure. The demand-hardening argument is unconvincing and misleading for many reasons.

First, the potential impact of demand hardening is overstated. Where citizens reduce per capita demand through technological and efficiency improvements, additional savings can be achieved during drought through behavioral changes. An example from the City of Long Beach, CA, shows that as a result of 22 years of continuing long-term conservation efforts, *total* potable water consumption in Long Beach is at the same level as it was in 1965, despite major increases in population. Even in the wake of these significant conservation savings, the city's recent drought-response measures decreased use an additional 17.2% below the historical 10-year average.

Second, economic considerations undermine demand-hardening arguments. Research has indicated that ignoring conservation and building excess water supply capacity is highly uneconomical – some authors say, "akin to over-feeding people so dieting will be easier." In addition, implementing long-term conservation programs is significantly cheaper than eliminating waste during drought years through

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[3] Maddaus, W., G. Gleason, and J. Darmody. 1996. Integrating conservation into water supply planning. *Journal AWWA* 88(11): 57-67.

[4] Kenney, D., Mazzone, M., Bedingfield, J. 2010. Relative Costs of New Water Supply Options for Front Range Cities. Natural Resources Law Center. University of Colorado. Boulder, CO. July.

[5] Colorado Department of Natural Resources, Colorado Water Conservation Board. 2011. Colorado's Water Supply Future, Statewide Water Supply Initiative 2010. Denver, CO. February.

water use restrictions. One study estimated that conservation is one-quarter of the price of dry-year drought-response measures.

Third, it is questionable public policy to encourage overuse of any limited resource. In a semi-arid watershed like the Colorado River Basin, where environmental health, the recreation economy, and the overall quality of life depend on instream flows and other uses of water, policies should promote efficient use of water and should discourage behaviors that necessitate additional water diversions from rivers and streams.

Fourth, demand hardening is only a concern during times of shortage, and only if the vast majority of conserved water is used to serve new customers. Most utilities will dedicate only a portion of conservation savings to serving new growth, reserving the remainder of conservation savings for system reliability or instream flow augmentation purposes. In times of drought, conserved water dedicated to these other purposes could be redirected to serving base demands, thus avoiding demand-hardening problems.

Water Quality

This Option could degrade the water quality of raw municipal sewage in terms of increased pollutant concentrations, but not in terms of total loadings. The quality of stormwater runoff would likely be improved through this Option as reductions in turf landscaping reduce the need for fertilizer and pesticide application. By reducing total diversions from the Basin's streams and rivers, this Option would likely improve overall instream water quality.

Energy Needs

A reduction in per capita use will translate into decreased energy requirements for a water provider. Decreasing per capita use will also decrease residential, commercial, institutional and industrial customers' energy demands for hot water, and will also reduce energy requirements associated with wastewater treatment. Given the carbon-intensity of energy production in the basin, this Option will generate the additional notable benefit of decreasing carbon loading by a non-trivial amount.

Hydroelectric Energy Generation

Hydroelectric generation may increase under the 1% per Year option, to the extent that these savings translate into decreased water exports out of the Colorado River Basin by municipal providers.

Recreation

Improving water efficiency allows utilities to serve an equivalent number of customers while diverting less water from the river. Reduced diversions will improve recreational opportunities.

Environment

Improving water efficiency allows utilities to serve an equivalent number of customers while diverting less water from the river. Reduced diversions will positively benefit ecosystems.

Socioeconomics

Socioeconomic impacts vary depending on the type of efficiency measures implemented. In general, however, reductions in per capita use lead to lower water and wastewater bills. Some of the measures

likely to be implemented, such as more efficient plumbing fixtures and landscape conversions, will generate new jobs.

Other Information

Many entities across the Colorado River Basin are currently planning to reduce per capita use at 1% per Year (or more) over the next several decades:

- The State of California has committed to reduce 2009 water use 20% by 2020 – nearly 2% per year.[6]
- Denver Water is aiming to reduce 2001 water use 22% by 2016, a goal of more than 1.5% per year.[7]
- St. George, Utah is planning to lower their per capita water use by 1.5-2% per year.[8]
- Southern Nevada Water Authority is planning to reduce 2008 water use by more than 50 gpcd by 2035, equivalent to 1% per year.[9]
- An Executive Order from President Obama has directed federal agencies to reduce potable water consumption by 2% per year through fiscal year 2020.[10] Many federal agencies have operations within the Basin.

[6] California Department of Water Resources. 2011. 20x2020 Water Conservation Plan. February. Available at: http://www.swrcb.ca.gov/water_issues/hot_topics/20x2020/docs/20x2020plan.pdf.
[7] Denver Water. Conservation Plan. http://www.denverwater.org/Conservation/ConservationPlan/ (accessed October 26, 2009).
[8] City of St. George. 2008. City of St. George Water Conservation Plan Update. January. http://www.sgcity.org/conservation/2008%20Conservation%20Plan%20Update.pdf.
[9] Southern Nevada Water Authority. 2009. Water Resource Plan 09. http://www.snwa.com/assets/pdf/wr_plan.pdf.
[10] The White House, Office of the Press Secretary. 2009. Executive Order: Federal Leadership in Environmental, Energy, and Economic Performance. October, 5.

Non-Comprehensive List of Individual Water Efficiency Measures

Option name: Water Loss Control and Reduction

Description of Activity: Water loss control is the practice of system auditing, loss tracking, infrastructure maintenance, leak detection, and leak repair for municipal water utilities. Auditing a water distribution system for real and apparent losses and evaluating the costs of those losses is the foundation of water loss control. Real losses are actual physical losses of water due to leaks or other problems with the system. Apparent losses are due to meter inaccuracy, unauthorized consumption, and data handling errors.

Water auditing and loss control give water utilities the potential to conserve significant volumes of treated water by reducing real losses and to increase revenue by reducing apparent losses. Water loss control is a foundational, cost-effective water conservation practice that should be implemented by every utility in the basin.

Amount of Water Generated: 2-6% of total municipal water demand. Water savings from water loss management programs depend on the ongoing level of loss. On average, current levels of water loss range between 8-12%. 6% water loss represents an efficient benchmark.

Technical Feasibility: The American Water Works Association's M36 manual details proper water loss methodology, and is considered the industry standard.

Legal/Policy Considerations: None.

Permitting/Environmental Compliance: No major permitting requirements. Water main repair/replacement may require local city or county permitting compliance.

Timeframe to Implement: Varies depending on existing level and types of loss (real or apparent). Initial audits use little more than a few hours of staff time, while meter replacement programs and/or significant water line repair could require weeks to months of effort.

Costs: Vary depending on existing level and types of loss. Initial audits use little more than a few hours of staff time. Meter replacement programs and/or significant water line repair can be million-dollar investments for larger utilities. Many water loss control measures **generate revenue** for a utility in the long run.

Socioeconomics: Utility customers do not have direct costs associated with water loss control. However, if large loss problems exist, customers will ultimately bear costs related to repair and replacement of infrastructure.

References:

Colorado Department of Natural Resources, Colorado Water Conservation Board. 2011. *Statewide Water Supply Initiative 2010*. January.

Colorado Department of Natural Resources, Colorado Water Conservation Board. 2009. *Utility Water Loss: A Review of Current Practices in Colorado, Requirements in Other States, and New Procedures and Tools*. July.

Colorado WaterWise and Aquacraft, Inc. 2010. *Guidebook of Best Practices for Municipal Water Conservation in Colorado.* Colorado WaterWise. Denver, CO.

Western Resource Advocates. 2010. *Arizona Water Meter: A Comparison of Water Conservation Programs in 15 Arizona Communities*. Boulder, CO.

Western Resource Advocates. 2007. *Front Range Water Meter: Water Conservation Ratings and Recommendations for 13 Colorado Communities*. Boulder, CO.

Option name: Land Use Planning and New Construction

Description of Activity: Many Colorado River basin communities with high growth rates anticipate their increasing water demand will exceed their current supplies. Water conservation measures that are "built in" to new development can significantly reduce the magnitude of new demands. This includes measures such as high-efficiency appliances and fixtures (e.g. Energy Star, WaterSense), xeric landscape design for individual residences, and cluster-type site development that maximizes natural (i.e. non-irrigated) open spaces. These practices are also appropriate for non-residential development. Increased interest in "green" building and green building programs like Leadership in Energy and Environmental Design (LEED), presents opportunities for water utilities to promote water efficiency in new construction.

One example of this practice is ordinances that limit the quantity of turf in front and/or backyards. Both the Southern Nevada Water Authority (in partnership with local governments) and the East Bay Municipal Utilities District have enacted regionally-appropriate landscape ordinances.

Amount of Water Generated: 20-50% of future municipal residential demand. Utilities anticipating significant growth and new construction in their service area will benefit most.

Technical Feasibility: No technical challenges.

Legal/Policy Considerations: This best practice can be implemented through local ordinances and codes such as model landscape codes, green building programs, and local building and plumbing codes. Proper jurisdiction must be determined for successful implementation and enactment may require approval of city or county government for some code provisions.

Permitting/Environmental Compliance: None.

Timeframe to Implement: Immediate.

Costs: Utility costs are limited and minimal.

Socioeconomics: Builders and residents each face different costs and savings potentials from rules for new construction. Upfront costs may be more expensive, but can be paid off through reduced utility bills.

References:

Colorado Department of Natural Resources, Colorado Water Conservation Board & Center for Systems Integration. 2010. *Colorado Review: Water Management and Land Use Planning Integration*.

Colorado WaterWise and Aquacraft, Inc. 2010. *Guidebook of Best Practices for Municipal Water Conservation in Colorado.* Colorado WaterWise. Denver, CO.

East Bay Municipal Utilities District. 2008. Water Service Regulations - Section 31, Water Efficiency Requirements.

Southern Nevada Water Authority. 2011. Turf Limitations. Accessed April 4, 2011, http://www.snwa.com/html/drought_turflimits.html.

United States Environmental Protection Agency. 2011. US Outdoor Water Use – WaterSense. Accessed March 23, 2011: http://www.epa.gov/WaterSense/pubs/outdoor.html.

Western Resource Advocates. 2009. *New House, New Paradigm: A Model for How to Plan, Build, and Live Water-Smart*. Boulder, CO.

Option name: Landscape Design Regulations

Description of Activity: The concept of design regulations is to ensure new landscapes are "water smart from the start." Across the Colorado River basin, urban landscape irrigation accounts for 50%, or more, of the total annual water demand for a utility. Decreasing the quantity of water used by choosing regionally appropriate plants, and improving the efficiency of water use through improved irrigation practices is perhaps the single most important urban water conservation effort than can be made in the basin. If all new landscapes are designed with water efficiency as a priority, there is tremendous potential to reduce future demands below what they might be otherwise.

Amount of Water Generated: 25-65% of future municipal outdoor irrigation demand. Landscapes built pre- and post-regulations in a single development provide evidence that this level of savings is achievable.

Technical Feasibility: No technical challenges.

Legal/Policy Considerations: Landscape regulations can be implemented through local ordinances and codes such as model landscape codes, green building programs, and local building and plumbing codes. Proper jurisdiction must be determined for successful implementation and enactment may require approval of city or county government for some code provisions.

Permitting/Environmental Compliance: None required.

Timeframe to Implement: Immediate.

Costs: Creating rules for new landscape and irrigation system design is a relatively inexpensive way to affect landscape water use. Costs for new rules fall less on utilities than on customers. However, passing ordinances costs legal fees, staff time for research and political capital, as well as additional costs for enforcement

Socioeconomics: Builders and residents each face different costs and savings potentials from rules for new construction. Upfront costs may be more expensive, but can be paid off through reduced utility bills.

Other information: In addition to water efficiency, well-designed and maintained landscapes also improve storm water management, provide recreation opportunities, offer habitat to local wildlife, and provide aesthetic benefits.

References:

Colorado WaterWise and Aquacraft, Inc. 2010. *Guidebook of Best Practices for Municipal Water Conservation in Colorado.* Colorado WaterWise. Denver, CO.

Schneider, J. 2008. *A Look into Water Conservation: An Evaluation of Landscape Water Regulations*. Master's Thesis. Department of Landscape Architecture/Regional Community Planning/College of Architecture. Colorado State University.

Western Resource Advocates. 2009. *New House, New Paradigm: A Model for How to Plan, Build, and Live Water-Smart*. Boulder, CO.

Option name: Landscape Water Budgets

Description of Activity: Across the Colorado River Basin, urban landscape irrigation typically accounts for 50%, or more, of the total annual water demand for a utility. Landscape water budgets are a powerful conservation tool for addressing landscape water use and encouraging efficiency. A landscape water budget compares actual metered consumption against the legitimate outdoor water needs of the customer based on landscape area, plant materials, and climate conditions.

Because many landscapes, particularly turf, can accept excess irrigation without damage, many irrigators are not aware of whether they are using water efficiently or grossly over-irrigating. A landscape water budget provides a reasonable target level of water use that is customized for each customer and landscape. Water budgets help water users better understand their consumption patterns and make sound decisions about how to best manage irrigation properly. Water budgets provide utilities with a powerful tool for identifying which customers are over-irrigating and could most benefit from efficiency

improvements. Water budgets can be incorporated into a utility rate structure but they are also useful in their own right outside of a rate structure as a tool for assessing water use.

Amount of Water Generated: 25% of municipal demand. Water budgets, particularly when linked with an increasing block rate structure, have led to significant reductions in water use in several communities. The savings achievable from landscape water budgets is largely based on the level of overwatering that occurred prior to implementation of the program.

Technical Feasibility: Two data points are required to implement a landscape water budget, the size of the landscape, and the water requirement of the plants on the landscape. These can be readily attainted through GIS, tax assessor records, physical measurement, or statistical sampling.

Legal/Policy Considerations: None.

Permitting/Environmental Compliance: None.

Timeframe to Implement: Immediate.

Costs: Utilities will incur costs in the form of staff or contractor time needed to develop and implement landscape water budgets. Utility billing systems may need to be upgraded to accommodate water budgets.

Socioeconomics: If landscape water budgets are used as the basis for billing and are linked to the water rate structure, then inaccuracies can affect customer's pocket books and an appeals process is warranted. If landscape water budgets are used for informational purposes only, then an appeals process is unnecessary.

Other information: Landscape water budgets are not just a good conservation tool; they can also help manage demand during a drought emergency. Landscape water budgets and water budget rate structures offer water utilities powerful tools for reducing demand during drought and for monitoring customer compliance with drought restrictions.

References:

Colorado WaterWise and Aquacraft, Inc. 2010. *Guidebook of Best Practices for Municipal Water Conservation in Colorado.* Colorado WaterWise. Denver, CO.

Mayer et. al. 2008. Journal AWWA. *Water Budgets and Rate Structures: Innovative Management Tools*. 100:5. May.

Option name: Enforcement of Water Waste Ordinances

Description of Activity: A water waste ordinance is a local regulation that explicitly prohibits the waste of water from a variety of sources including (but not limited to) excess irrigation runoff, irrigation

occurring a prohibited day and/or time, excessive pavement washing, failure to repair leaks, utilizing single-pass water cooling, or improper maintenance of cooling towers.

A water waste ordinance is an important regulatory tool for water utilities that serves several useful purposes, including: 1) establishing the importance of wise water stewardship in a community and a utility's intent to put its water resources to maximum beneficial use; 2) establishing penalties for the blatant waste of water; and 3) providing an important regulatory "stick" during a drought when agency-wide restrictions are put in place and enforcement is required to ensure water supplies are adequate.

Amount of Water Generated: 50% of commercial and residential outdoor irrigation demand, or more. The USEPA estimates up to 50% of commercial and residential irrigation water use goes to waste due to evaporation, wind, improper system design, or overwatering. Significant waste also occurs in every community from failure to repair leaks, single-pass water cooling, and other activities. Water savings achieved through a waste-prohibition ordinance depend largely upon the level of publicity and enforcement given to the rules.

Technical Feasibility: No technical challenges. Existing providers can offer good models for the text of water waste ordinances and the variety of enforcement mechanisms.

Legal/Policy Considerations: A water waste ordinance is usually enacted by the municipality or local government, often at the request of the water utility, but not by the utility itself.

Permitting/Environmental Compliance: None required.

Timeframe to Implement: Immediate.

Costs: Implementing a water waste ordinance is inexpensive and usually only requires that an ordinance be prepared by staff and then approved by the City Council or other leadership body. Enforcing a water waste ordinance requires staff time from the water utility and possibly from other city service workers.

Socioeconomics: A water waste ordinance does not place costs on the customer *unless* they are caught in violation of the rules at which point they may be subject to a penalty, much like a traffic ticket. A well enforced water waste ordinance can create a beneficial "culture of conservation."

Other information: A water waste ordinance on the books, even if it is not actively enforced in normal water years, can be extremely important during a drought. When demand reductions are required to ensure minimum supply levels during a drought, a water waste ordinance is an essential tool for water providers and gives the necessary enforcement power to cite, and if necessary fine, those who do not obey drought restrictions.

References:

Colorado Department of Natural Resources, Colorado Water Conservation Board. 2011. *Statewide Water Supply Initiative 2010*. January.

Colorado WaterWise and Aquacraft, Inc. 2010. *Guidebook of Best Practices for Municipal Water Conservation in Colorado.* Colorado WaterWise. Denver, CO.

Option name: Water Audits

Description of Activity: Water surveys and evaluations – frequently referred to as "audits" – identify water savings opportunities and educate customers on water wise behavior. Audits are also a practical, non-regulatory approach to improving water use efficiency.

During a water audit, a trained technician evaluates the efficiency of all points of water use on the property. Audits then identify concrete methods for reducing water waste, improving efficiency, and often reveal leaks and unintended water usage of which some customers are simply unaware. Audits can be used to evaluate indoor, outdoor, and non-residential sectors, but in all cases, should be targeted first to high volume customers in order to maximize water savings and minimize program expenses.

Amount of Water Generated: 10-20% of indoor demand for high water-using residential customers; 10-40% of outdoor demand for high water-using residential customers; 15-50% of total demand for non-residential customers.

Technical Feasibility: No technical challenges.

Legal/Policy Considerations: None.

Permitting/Environmental Compliance: None.

Timeframe to Implement: Immediate.

Costs: Utility staff time and/or contractors will be required for the development of water audits. A short, indoor residential site survey may cost $50 - $100 per site to implement. A comprehensive indoor and outdoor facility audit may cost between $100 and $1,000 depending upon site specifics.

Socioeconomics: Customers may see significant costs from pursuing recommended conservation measures. However, if substantial savings are realized, customers may also see reasonable payback from water and wastewater savings.

Other information: There are numerous other benefits to improving water use efficiency, including: lower wastewater bills, reduced energy use, improved landscape appearance, reduced runoff, reduced fertilizer and chemical requirements, reduction in labor costs, and avoided costs from over- or under-watering leading to landscape damage.

References:

Center for ReSource Conservation. 2007. *Irrigation Inspection Program: Impacts of Slow the Flow Colorado on Outdoor Water Use*. June.

Colorado WaterWise and Aquacraft, Inc. 2010. *Guidebook of Best Practices for Municipal Water Conservation in Colorado.* Colorado WaterWise. Denver, CO.

Option name: Public Education and Awareness Campaigns

Description of Activity: Public information and education are broad best practices that encompass social marketing, school education, public outreach, and other informational efforts aimed at raising awareness and fostering a culture of conservation and behavior change. Central components of a successful campaign include effectively communicating the value of water, and delivering consistent and persistent messages about the importance of conservation and efficiency efforts.

Examples from Denver Water's "Use Only What You Need" campaign are especially effective:

Amount of Water Generated: Variable. While utilities may not be able to rely on water savings from a public outreach campaign alone, education and awareness efforts increase participation levels in other utility sponsored programs such as landscape audits and rebates. Conservation outreach programs help establish a culture of wise water stewardship, which over time results in behavior change and effective action such as replacing inefficient fixtures and appliances.

Technical Feasibility: No technical challenges.

Legal/Policy Considerations: None.

Permitting/Environmental Compliance: None required.

Timeframe to Implement: Immediate.

Costs: Depends on the type of program, size of utility, and level of implementation. For an agency with 5,000-25,000 connections, an annual outreach program budget between $10,000 and $50,000 should be sufficient to implement a basic print media and bill stuffer campaign. Larger budgets will be required to implement a mixed media program with web, billboards, and radio spots. Television is probably the most expensive media both in terms of production and placement. It is cheaper to use existing programs already developed such as Project WET.

Socioeconomics: An educated and engaged public that recognizes the value and scarcity of water is a step forward in managing basin resources.

Other information: Conservation education and outreach campaigns provide multiple benefits to water providers including: framing the provider as a wise steward of essential water resources; framing the provider as a knowledgeable source of information about water use and conservation; informing customers about different conservation program offerings; increasing participation in all utility resource conservation programs.

References:

Colorado WaterWise and Aquacraft, Inc. 2010. *Guidebook of Best Practices for Municipal Water Conservation in Colorado.* Colorado WaterWise. Denver, CO.

Denver Water. 2011. Use Only What you Need. Accessed March 28, 2011: http://www.denverwater.org/Conservation/UseOnlyWhatYouNeed/.

Option Name: Lawns to Xeriscape

Description of Activity: Replacement of residential and commercial turf-grass lawns with low-water use vegetation and prohibitions on installation of new turf. Such replacement programs have been successful in several regions, with demonstrated savings in consumptive water use. Although providing rebates for turf replacement can be relatively expensive (SNWA now offers $1.50 per square foot), water agency rebates can reduce the total cost to the end user. Combined with real-cost water pricing and creative public service messages, such rebates can incentivize people to tear out their water-hogging lawns and replace them with climate-appropriate vegetation. Additionally, local governments have prohibited turf installation in new commercial developments, in new residential front yards, and as more than 50% of backyard landscaping. The combination of incentives and regulations can effectively reduce outdoor irrigation demand and yield consumptive water savings.

Amount of Water Generated: Water savings from properly designed xeriscaped yards can be 30 to 70 percent or even more over badly managed turf lawns, while still producing beautiful gardens. A study by the Irvine Ranch Water District in Orange County, California found a savings of over 50 percent (1.4 acre-feet per acre) in homes landscaped with native plants rather than turf. The Southern Nevada Water Authority concluded in a five-year study that converting turf to water-efficient landscaping saves 76% of the water; SNWA estimates the total water savings of its “Cash to Grass” program at almost 26,000 acre-feet each year. An Arizona study concluded that while a 3,000 square-meter turf lawn used 9,000 to 15,000 gallons of water per month, that same area covered with native plants, shrubs and trees used only 800 to 1,300 gallons per month. A 2002 study in Colorado Springs found xeriscape saved from 22-63% of the water used on traditional turf lawns. Since more than 50% of most residences’ water use is outdoor, these savings can be significant. Extrapolating from SNWA’s program suggests that more than 100,000 acre-feet of consumptive Colorado River water use could be realized each year.

Technical Feasibility: Existing, proven technologies that have already been implemented in many areas.

Legal/Policy Considerations: Rebate programs can be readily implemented. Ordinances prohibiting new installation would require action by local governments.

Permitting/Environmental Compliance: Not required.

Timeframe to Implement: SNWA's program has ramped up over a decade; similar programs in other areas have recently begun and could be expanded.

Costs: To date, SNWA has invested almost $168 million in its Cash for Grass program and has reportedly conserved almost 128,000 acre-feet since 1999; per acre-foot costs will continue to decline as turf-replacement yields long-term consumptive use savings. These costs do not reflect the owner's actual costs, or their savings due to reduced water use.

Socioeconomics: Turf replacement creates jobs for landscapers, and saves end users money.

References:

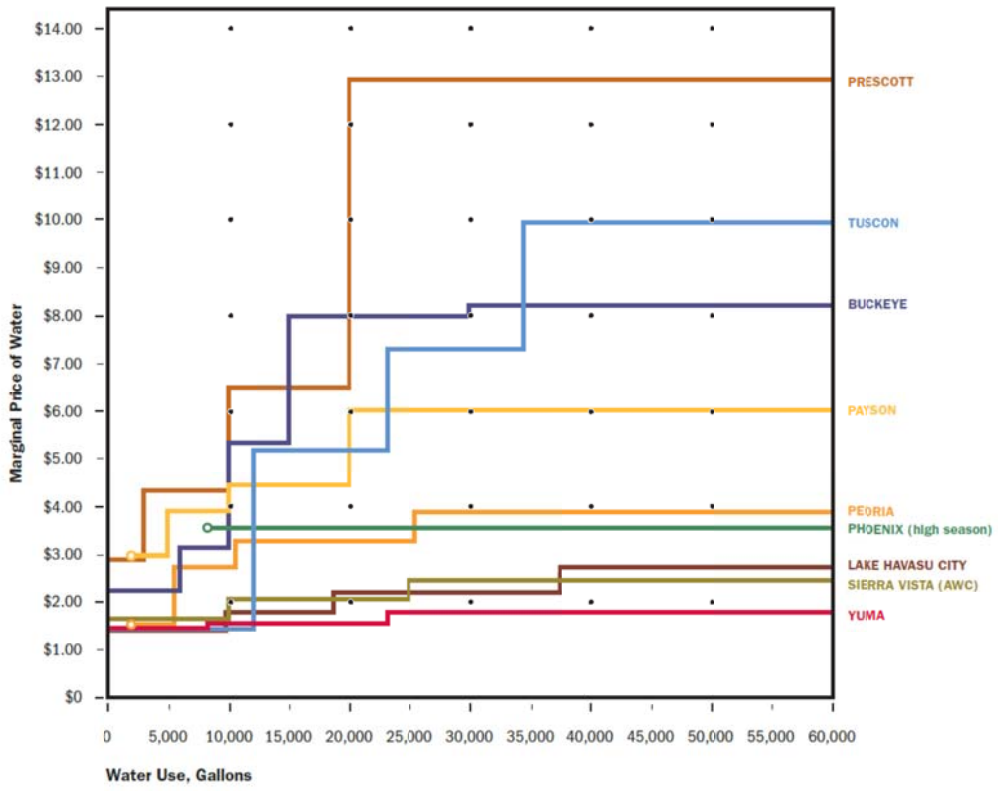
Brean, Henry. 2011. Turf-rebate program sees success. *Las Vegas Review-Journal*. February 21. Available at http://www.lvrj.com/news/turf-rebate-program-sees-success-116586443.html.

Cooley, H. et al. 2010. *California's Next Million Acre-Feet: Saving Water, Energy, and Money.* Pacific Institute. Available at http://www.pacinst.org/reports/next_million_acre_feet/index.htm.

Option Name: Inclining Block Rates

Description of Activity: Consumers respond to appropriate price signals. Through an inclining block rate structure, the unit price for water increases as water use increases, as shown in the figure below. Customers who use low or moderate volumes of water are charged a modest unit price; those using significantly higher volumes pay markedly higher unit prices. When designed properly, this approach generates a strong financial incentive to conserve while ensuring that lower-income consumers are able to meet their basic water needs at a reduced cost. A 2003 survey of water rate structures in the southwest United States found that per capita water use is typically lower in cities with dramatically increasing block rates, such as Tucson and El Paso. Water agencies can structure increasing block rates to offset declining revenues associated with reduced water sales, by shifting the cost burden to high water users.

Many water agencies are moving beyond simple volumetric pricing and are beginning to more consistently implement rate structures and pricing policies that communicate the value of water and encourage efficient use. Increasing block rates are among the most common conservation-oriented rate structure implemented by water agencies, though the rate structures vary across water agencies, as shown in the figure below. A greater number of tiers and steeper changes in rates between tiers, combined with low fixed charges and low or inclining block rates for wastewater, are most effective.



Inclining Block Rates for several Arizona Cities (WRA 2010).

Amount of Water Generated: Well-designed inclining block rate structures can decrease demand 10-30%.

Technical Feasibility: Existing practice.

Legal/Policy Considerations: Typically, only requires municipal water agency to change its rate structure.

Permitting/Environmental Compliance: Not required

Timeframe to Implement: May require a brief roll-out period to familiarize customers with new rate structure; typically can be implemented fully within one to two years.

Costs: Variable, depending on staff time, data requirements**,** existing accounting and billing systems, customer education and outreach, and customer service requirements.

Socioeconomics: Designed correctly, inclining rate structures will reward water conserving customers with lower rates, while water wasters will pay more.

References:

Colorado WaterWise and Aquacraft, Inc. 2010. *Guidebook of Best Practices for Municipal Water Conservation in Colorado.* Colorado WaterWise. Denver, CO. Available at

http://www.coloradowaterwise.org/Resources/Documents/BP%20Project/CWW%20Best%20Practices%20Guide%20-%20FINAL.pdf.

Cooley, H. et al. 2010. *California's Next Million Acre-Feet: Saving Water, Energy, and Money.* Pacific Institute. Available at http://www.pacinst.org/reports/next_million_acre_feet/index.htm.

Western Resource Advocates. (2003). *Smart Water: A Comparative Study of Urban Water Use Efficiency Across the Southwest*. Boulder, Colorado.

Western Resource Advocates. (2010). *Arizona Water Meter: A Comparison of Water Conservation Programs in 15 Arizona Communities*. Boulder, Colorado.

Option Name: Residential Retrofits

Description of Activity: Replacement of residential fixtures and appliances – such as toilets, showerheads, dishwashers, and clothes washers – with high-efficiency models, and installing faucet aerators. This option will reduce water demand and save energy throughout the residential sector. Municipal water agencies can offer rebates or vouchers to customer, to subsidize the cost of new, high-efficiency fixtures and appliances; such programs have proven successful in many areas using Colorado River water. Local or state governments can adopt "retrofit on resale" or "retrofit on reconnect" regulations, requiring that properties changing ownership have high-efficiency fixtures and appliances. California recently adopted such an ordinance. Such requirements shift the costs of replacement to the end-user, who benefits from lower water and energy costs. Municipal water agencies can also identify pre-1995 homes – those most likely to have low-efficiency fixtures and appliances – and target rebate and voucher programs to such homes, especially in lower-income areas that might be less able to cover the initial up-front costs.

For example, installing five million showerheads and five million faucet aerators throughout the basin states, in residences using Colorado River water, would require an initial one-time investment of about $180 million and would reduce water demand by an estimated 80,000 acre-feet annually for a period of ten to twelve years. The energy savings (from avoided water conveyance and especially from avoided water heating costs, as well as from avoided water treatment costs) would generate a very fast return on this investment, so that total costs would be negative.

Amount of Water Generated: Total water savings depends on extent and duration of municipal retrofit programs. Potentially, well over 100,000 acre-feet could be conserved each year, offsetting an even larger volume of demand (accounting for system losses), saving water and wastewater treatment costs, as well as conveyance costs. With high efficiency fixtures and appliances, indoor single-family residential use can fall to 35 GPCD or less. More than a decade ago, select homes in Seattle achieved an indoor rate of 38 GPCD. For many cities in the basin states, this would represent a reduction in municipal water demand in excess of 30%.

In some cases, such replacement programs merely accelerate the rate at which inefficient fixtures and appliances would have been replaced. (That is, as clothes washers and showerheads break over time, they are replaced with current, more efficient models.) Nonetheless, such acceleration represents a real savings of both water and energy, stimulates the market for more efficient products, and heightens consumer awareness of water conservation.

Technical Feasibility: Existing, proven technologies that have already been implemented in many areas. Some areas have already effectively replaced as many toilets in their service areas as has been feasible via voucher and retrofit programs, but considerable opportunity exists in other areas, especially in communities with pre-1995 residences, with old, 6-gallon per flush toilets.

Legal/Policy Considerations: "Resale on Retrofit" or similar programs may require new ordinances.

Permitting/Environmental Compliance: Not required

Timeframe to Implement: Variable, based on method(s) used.

Costs: Variable, based on method(s) used. Some utilities, such as Denver Water, offer rebates for toilets and clothes washers; costs include the direct value of the rebate, plus overhead and processing costs. In some areas, local energy utilities, such as SDG&E, may also offer rebates for some home appliances such as dishwashers and clothes washers. Ordinances, such as requiring 'retrofit on resale,' shift the costs to the end user, who ultimately benefits from lower water and energy costs.

Socioeconomics: This option will create jobs, for plumbers and others installing the new fixtures and appliances, will stimulate demand for high-efficiency appliances, and will save end users money. Programs targeted at lower-income areas could benefit such communities by lowering their utility bills.

References:

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Option Name: Commercial Retrofits

Description of Activity: Replacing conventional fixtures and appliances with high-efficiency commercial toilets, urinals, clothes washers, restaurant pre-rinse spray valves, pressurized water brooms, and cooling towers can reduce water demand and save energy throughout the commercial and institutional sectors. Municipal water agencies can offer rebates or vouchers to commercial and institutional customers, to subsidize the cost of new, high-efficiency fixtures and appliances; such programs have proven successful in many areas using Colorado River water. Local or state governments can also require high-efficiency fixtures and appliances in commercial and institutional establishments (such as schools, stadiums, and airports).

Amount of Water Generated: Total water generated varies by fixture type and success of retrofit programs. For example, the initial incremental cost of replacing 750,000 urinals throughout the Colorado River basin states would be about $9.3 million and would save an estimated 52,000 acre-feet annually, with a rapid return on investment in the form of lower water bills. Installing pre-rinse spray valves in restaurants and distributing pressurized water brooms could generate another 10,000 acre-feet annually.

In some cases, such replacement programs merely accelerate the rate at which inefficient fixtures and appliances would have been replaced. (That is, as toilets and washing machines break over time, they are replaced with current, more efficient models.) Nonetheless, such acceleration represents a real savings of both water and energy and stimulates the market for more efficient products.

Technical Feasibility: Existing, proven technologies have already been implemented in many areas.

Legal/Policy Considerations: New ordinances requiring high-efficiency fixtures and appliances would require action by local governments.

Permitting/Environmental Compliance: Not required.

Timeframe to Implement: variable, depending on value of rebates.

Costs: Variable, based on method(s) used. Some utilities, such as Denver Water, offer commercial rebates for toilets and urinals; costs include the direct value of the rebate, plus overhead and processing costs. In some areas, local energy utilities may also offer rebates for energy-saving fixtures such as restaurant pre-rinse spray valves. Ordinances shift the costs to the business owner, who ultimately benefits from lower water and energy costs.

Socioeconomics: This option will create jobs, for plumbers and others installing the new fixtures and appliances, will stimulate demand for high-efficiency appliances, and will save end users money.

References:

Colorado WaterWise and Aquacraft, Inc. 2010. Guidebook of Best Practices for Municipal Water Conservation in Colorado. Colorado WaterWise. Denver, CO. available at http://www.coloradowaterwise.org/Resources/Documents/BP%20Project/CWW%20Best%20Practices%20Guide%20-%20FINAL.pdf

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Option Name: Metering Multi-Family Use

Description of Activity: A simple economic principle tells us that when people must pay for a resource, they will use less of it. Most single family residences using Colorado River water are now billed according to their actual use, rather than by a flat rate. However, most multi-family residences are not metered and so cannot be billed according to actual use. Installing water meters for multi-family residential customers and charging them for the water they actually use would substantially reduce water demand, and would enable implementation of inclining rate block structures (see "Rate Structure" option). In addition to reducing household water use, meters are also critical for effective management of the water system. Water providers can use this information to target water conservation and efficiency programs to particular customer classes and determine the program's effectiveness. Meter data is also an extremely valuable audit tool that can help locate leaks within the distribution system and at the customers' homes. New ordinances could require sub-meters on all new multi-family residences, and could require the installation of sub-meters on existing multi-family residences with a reasonable period of time.

Amount of Water Generated: When presented with information on how much water they are actually using – especially if this information is placed in the context of how much water their neighbors use – customers reduce their demand. The City of Davis, for example, installed meters on nearly 10,000 homes and began a metered billing rate, effectively reducing per-capita water use by 18%. The City of Clovis, which uses water meters, has an average per-capita use nearly 40% lower than the neighboring City of Fresno, which does not use water meters. In Denver, metering reduced water use by 28%. A detailed study of multi-family residential water use found that sub-metering decreased water use by 10.7% to 25.7%, with an average savings of 15.3%. Multi-family residential water use varies by municipality, but often exceeds 14% of total water agency deliveries. Sub-metering such properties could reduce total municipal demand by more than two percent.

Technical Feasibility: Meters and sub-metering are existing technologies.

Legal/Policy Considerations: May require new ordinances.

Permitting/Environmental Compliance: Not required.

Timeframe to Implement: New ordinances could require sub-meters on new construction, and retrofitting of existing multi-family residences within three to five years. Customers typically respond very quickly to bills based on actual consumption, especially if these are based on inclining rate structures or other suitable price signals.

Costs: Variable, depending on type of meter and existing infrastructure. Lodi, California, is charging residents $300 per meter and is covering the additional costs of upgrading existing infrastructure. There are also regular administrative costs associated with reading the meters and billing customers according to actual use; for multi-family residences, this would increase the number of accounts.

Socioeconomics: This option will create jobs, for plumbers and others installing the new meters. Some multi-family residents might see higher expenses.

References:

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Option Name: Pool Covers

Description of Activity: Swimming pools are very abundant in many parts of the Southwest – more than 300,000 in metro Phoenix alone. They are water and energy intensive. Pool covers reduce evaporation, saving water. Some municipal agencies provide rebates to those purchasing pool covers. Similar programs could be implemented throughout the Southwest. To achieve greater, more permanent and verifiable water savings, water agencies could also provide rebates to homeowners who remove their swimming pools.

Amount of Water Generated: SNWA reports that each pool cover can save 10,000-15,000 gallons per year. The City of Glendale, Arizona reports that pool covers save an average of 16,000 gallons of water per pool each year. If half of Phoenix pool-owners used covers, they would save more than 7,000 acre-feet annually, in consumptive losses. Permanently removing swimming pools would generate greater water savings.

Technical Feasibility: Existing, proven technology.

Legal/Policy Considerations: None.

Permitting/Environmental Compliance: Not required.

Timeframe to Implement: Programs can implemented quickly.

Costs: SNWA provides rebates for $50 or 50 percent off the purchase price of a pool cover, whichever is less, or $200 or 50 percent off the purchase of a permanent, mechanical pool cover. Total costs will also include administration and processing costs. Local energy utilities may contribute to program costs, given potential reductions in energy needed to heat covered pools. Rebates for permanent swimming pool removal could be more costly, but will generate longer term water conservation.

Socioeconomics: Saves customers money by reducing their water bills.

References:

Beard, Betty. 2007. Backyard retreats suck water, energy. *The Arizona Republic*. July 16. http://www.azcentral.com/news/green/articles/0716greenpools0716.html

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