The Colorado River Workshop
Issues, Ideas, and directions

# EFFICIENT WATER USE IN THE COLORADO RIVER BASIN

## opportunities and implications

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With the many interests competing for Colorado River water today, making more efficient use of that water is an obvious place to look for relief. The technologies and often-overlooked management know-how to wring much more use out of each drop of the Colorado already exist and can help turn this competition into collaboration between water use sectors. But important questions arise. Who will pay? What are the social implications of aggressive marketing of saved water? What are the opportunities for collaboration between cities and agriculture? What is the future of agriculture in the Colorado River Basin? Does the environment win or lose? What are the limits of efficiency? How might climate change affect the picture? Looking to the future of the Colorado River, efficiency is essential, but so is a whole-system view and the institutional ability to allow all stakeholders to consider the economic, environmental, and social implications of these measures over the long term. Changes will happen. The question is whether they will be smooth transitions or result in unnecessary social, economic, and environmental disruptions. Foresight and a will to guide these changes gracefully toward a desired future is essential.

# INTRODUCTION

## *Users' Guide To This Paper*

This paper is designed to provide some background and suggest some discussion points for the Grand Canyon Trust's stakeholder workshop under their cooperative agreement with the Bureau of Reclamation. That workshop is to provide the Bureau with stakeholder views on the water resource issues in the basin for the next few decades. No attempt has been made to provide a comprehensive background, but rather the views of a generalist attempting to look at the big picture with particular attention to the processes involved in addressing the issues raised. Some opinions may have snuck in as well — the reader may not agree with them, but hopefully they will stimulate discussion. Workshop participants have many resources available — extensive literature and the combined wealth of knowledge of the workshop attendees themselves. The references at the end of this paper are primarily those familiar to the author that provide details on points made in this particular paper — a comprehensive listing of sources is impractical here.

The term efficiency is used in this paper to refer to practices which generally provide the same or better water-related services using fewer resources. This might include getting a better shower, the same or better crop yield or better yet, farm profit, with technologies and techniques which use less water. The term conservation is avoided here since it means so many different things to different people — it may include rationing and brown lawns or fields under the same umbrella as improved yields from advanced irrigation monitoring and scheduling schemes. Efficiency relates water use to end uses and the quality of the services that water provides. When possible, it includes resources other than water used in providing those services — for example, the energy savings from heating less water for an efficient shower or pumping less water in a more efficient irrigation system.

This paper will look at why efficiency has become an issue, what the opportunities and impediments are now and will be into the future, and the broader context in which many think efficiency should be viewed. The fundamental goal is sustainability in water management — economically, environmentally, and socially sound ways of managing our water resources. Efficiency has an important role in such a system.

## THE RISE OF EFFICIENCY AS AN ISSUE

### *Technology To The Rescue?*

It can be argued that the path that has led to efficiency becoming an issue in the Colorado River Basin can be traced back to the sense of relative abundance that led to the water development projects in the West over the last century. Many of these developments were quite dependent on subsidies. Governmental support of irrigation, municipal supply, and hydropower development as well as general farm subsidies were key to initiating many of these projects. These subsidies tended to hide the real cost of water, and further the perception of abundance. The related development of the "use it or lose it" approach to water rights was a commonsense method of avoiding waste of the resource.

With this historical background, several more recent events further set the stage. Increasing demands within the traditional water use sectors of agriculture, municipal supply, and hydropower and the increasing prominence of environmental concerns, Native American rights, and recreation interests has led to divisive competition. The intensity of this competition made the development of new efficiency techniques quite welcome, with most attention being given to the technologies at the expense of better management and behavioral changes. The lack of cooperation between sectors, the continuing perception of abundance, subsidies, and the "use it or lose it" concept all appear to have contributed to the present application of efficiency options in a rather piecemeal, short-sighted fashion, failing to take full advantage of efficiency's potential contribution to alleviating water scarcity and allocation problems.

Certain municipal water managers are implementing efficiency improvements aggressively, while others ignore its promise. At times, the "saved" water goes directly to new development with no question as to whether that is in the community's interest. Others are tempted to avoid efficiency and prefer the scarcity that they believe will stifle growth. Some farmers show impressive and profitable irrigation savings, while others see it as a good way to lose their valuable water rights and alienate their neighbors through third-party effects. Some farm groups are fearful of the precedent of saving water for cities to use — literally opening the floodgates.

The issue surrounding efficiency seems to be in determining its real promise in helping resolve our scarcity and allocation problems and in how to replace the disincentives and impediments to its implementation with cost-effective incentives. How can cross-sector collaboration be achieved? Who should pay? To what uses should the saved water be put? Most importantly, who should make these decisions? That is the challenge of efficiency now and most likely into the future.

## MUNICIPAL EFFICIENCY

### *An Undertapped But Finite Oasis*

Water efficiency in the municipal sector has great technical potential, some of which is being tapped by progressive communities now. In the residential and light-commercial sector, water-efficient fixtures can usually cut water use by a third or more very cost-effectively. These highly efficient showerheads, faucets, and toilets are designed to provide the same or better service using less water. In fact, any fixture that does not do the job well — and some don't — should not be called efficient. It may use less water, but it has not provided a satisfactory water-related service. Such poor performers typically undercut the credibility of residential efficiency programs. Research and development efforts should focus on consumer satisfaction and job performance as much as on frugality of water use. The potential of industrial efficiency is very task-specific, but savings and cost-effectiveness are equally impressive.

Besides saving water, these efficiency measures have many other benefits, several of which derive from the fact that residential water is usually pumped, treated to high quality, often heated, and treated again after use. The hot water energy savings from showerheads and faucets can lead to payback periods measured in months. The avoidance or deferral of major capital outlays for dams or other water supply projects and for sewage treatment facilities can more than pay for efficiency. The environmental and social disruptions of these projects and unnecessary energy use can be avoided as well.

Opportunities for implementation of efficiency in urban areas are equally impressive, largely due to its cost-effectiveness. Scores of communities across the country have put together programs with high rates of savings.

While fixture requirements and other ordinances are effective, greater savings and social acceptance can occur when incentives are put in place to reward consumers for using less water. Progressive rate structures and sliding-scale hookup fees for new service encourage innovation and savings that can go far beyond that from mandating uniformly efficient fixtures or other measures. In many cases, the capital, operational, and maintenance savings lead water and energy utilities to support rebates, giveaways, and other support for consumer efficiency as part of their demand management programs. (*Water Efficiency*, Rocky Mountain Institute, 1991 describes a multitude of implementation options and case studies of successful programs.)

While the promise of efficiency for municipalities is great, challenges do exist. When a supply or treatment crisis arises, efficiency is often not considered on a par with large construction projects. While efficiency may be cheaper, communities seem to find it easier and more comfortable to invest in large supply and treatment projects with much, much longer payback periods. Water use reductions can also cause revenue losses, at least temporarily, that can cause cash-flow problems for utilities. Presumably, the implementation of efficiency measures at the appropriate rate should allow utilities to benefit from the cost-effectiveness of their efforts. The challenge is to properly time efficiency improvements and to find ways to finance them at least as easily as major construction.

A second challenge is in determining the fate of the saved water. Where does it go? To the environment? Why is the water being saved? New municipal development will usually pay the most for the "saved water", and utilities can avoid selling less water and be spared the associated fluctuations in revenue. The development interests themselves are often the most inclined to invest in efficiency — it pays. Usually, the community does not consciously choose the fate of the saved water — the question doesn't arise. The well-being of the community as well as consumer resolve to use water more efficiently both depend on addressing this question. For the community that has not yet determined how to plan for a sustainable future, water efficiency can buy time to develop their vision, but since even efficiency is finite, so is the time bought.

## AGRICULTURAL EFFICIENCY

***Much Promise, Many Disincentives***

The technical potential to save water in irrigated agriculture appears enormous. In light of the huge quantities of water used, even a small percentage efficiency improvement is significant. Gated pipe, low pressure precision application (LEPA) systems, and surge valves all help reduce evaporative and seepage losses. Conversion from flood to sprinkler application or use of tailwater recovery can use much less water. Soil moisture monitoring devices such as gypsum blocks can help with scheduling. Often overlooked are the many non-technological management improvements such as more accurate scheduling that can bring about major water use reductions. In many cases, all these improvements can increase yields and cut operating costs. Some changes can be inexpensive, while others such as drip irrigation can entail high capital outlays.

Curiously, saving water is often not the reason for irrigation improvements. The many wider benefits of efficiency are illustrated by farmers who use efficiency to reduce pumping energy costs, alleviate salinity and other water quality problems, reduce erosion and sedimentation, and improve yields as mentioned above. Government agencies lend technical and financial support in order to reduce ground and surface water



pollution and salinity. Energy utilities go beyond pump efficiency assistance to rebates and other assistance to reduce water use as well as energy as part of their demand-side management programs. (See the three RMI irrigation efficiency reports in the references section for more details on these programs.)

However good the improvements may look on the field scale, it is in the broader context that impediments arise. In many western states, the farmer may lose the rights to any water saved. He or she may not be able to apply that water to other land on the farm or to sell it. What greater disincentive to efficiency could there be, especially in areas where the inherent value of the land may essentially be in the water rights. If the rights to saved water could be retained, how much engineering and legal effort must be expended (paid for) to determine the quantity of water actually freed up and any third-party effects— injury to nearby farms or environmental concerns. The question often comes down to determining the amount of consumptive use avoided, which can be hard to agree upon and in quantities much less than the reduction in diversions. Impressive savings still exist. The challenge here is to turn the formidable disincentives into incentives that reward the farmer and meet societal needs.

## COLLABORATIVE EFFORTS

***"Win-Win" Possibilities***

The real opportunities for creative and so-called "win-win" solutions lie in collaborative efforts among the various water use sectors. Cities want water and will generally be able to pay whatever it takes to get it, although not without grumbling. Agriculture has water. The least imaginative solutions are for cities to "buy the ranch" and all the water that goes with it. At best, the land may be revegetated after the farmer leaves, often a weed patch is all the rural community has left. Granted, irrigated agriculture may not be appropriate in some areas, but that may be best made as a conscious decision with input from all the stakeholders involved.

A more appropriate solution might be for the city needing water (presumably after implementing all cost-effective efficiency) to make a modest investment in irrigation efficiency and get its water at a reasonable price, hopefully leaving the farmer with a more economical operation and more viable rural community. A healthy awareness of interdependence between the city with the market and the farms with the food supply could be fostered. The environmental and social costs of a new supply project may be avoided as well. Agricultural reuse of municipal wastewater and dry-year leases are other examples of collaboration between cities and farms.

Other environmental benefits may result from commonsense efficiency improvements. Agricultural measures that free up water while reducing surface or groundwater pollution, erosion, or salinity buildup should be priorities for possible investments from environmental interests. Similarly, high leverage environmental gains could accrue from municipal efforts to save water while reducing energy use and associated pollution by using less heated water. It should be noted that in certain cases very real environmental benefits can result from reduced diversions even if only a small portion represents a reduction in consumptive use — the increased river flow between the point of diversion and the original return flow location may be a net gain.

Some have suggested programs that would move a set fraction (perhaps 25%) of the water freed up by irrigation efficiency automatically to the state for instream flows or similar environmental interests. Farmers would retain the original priority rights to their saved water and would be free to use, sell, lease, or hold in stream for later use, the remaining portion of the saved water. The original priority date would be maintained for the water dedicated to instream flow so it has a real, rather than token, environmental benefit. This type of program would require some administrative changes in many states, but the potential benefits are promising. The initial investment in irrigation improvements could come from the farmer, environmental interests, the state, or a city needing water, but benefits would accrue to all involved. (See "Moving Saved Water to the Environment" in the references for details on Oregon and Washington initiatives.)

It often takes a step back from everyday crises to recognize the opportunities for collaboration with other water use sectors, to change from a competitive to a cooperative mindset. But in order to move beyond wishful thinking to reality, it will be necessary to transform the bureaucratic and legal barriers — many of which were designed to protect personal rights and the environment — into efficient procedures that will promote economically, environmentally, and socially sustainable water management.

## FUTURE CHALLENGES

### *"No-Regrets" Strategies*

Change in the future is inevitable. In fact, the business of sustainability is one of pursuing a moving target. What works today may well not tomorrow. Efficiency is one tool that can help meet tomorrow's challenges, or it may be used without foresight and purpose leaving all available water resources fully allocated to highly efficient, but in some cases, inappropriate uses.

It takes little imagination to picture a future with increasing demands for high quality in drinking water, greater calls for environmental protection, more intense competition, continued financial struggles to maintain infrastructures, increasing energy prices, and tougher competition from foreign farmers. Efficiency can play a role in addressing all of these problems in the future as well as today. It's one of those "no-regrets" strategies that should be a top priority in preparing for the future — coping directly with today's problems in ways that prepare for the future.

A look at the reconstructed natural Colorado River flow for the past hundred years shows strikingly that climate is not static either. Tree rings indicate a climate over the past few centuries closer to today's than to the higher flows of the 1920s when the compact divided up the Colorado's water. Why shouldn't the climate change?

Most climatologists expect significant human-induced climate change over the next century, bringing an unpredictable regional mosaic of most likely higher temperatures and evapotranspiration, more or less precipitation, and different snowfall and snowmelt patterns. Most likely this will occur at a rate that will allow human adaption of agriculture and other activities, avoiding catastrophes in most cases. There will be costs, social disruption, perhaps dramatic disturbances of natural ecosystems, but adaption will be possible — adaptions perhaps to increased floods, higher irrigation requirements, earlier snowmelt regimes, and the like. Some, however, are more concerned with a much less likely but potentially catastrophic scenario — a very rapid change in climatic conditions. Disconcerting paleoclimatic evidence indicates that this is a very real, but small possibility. Preparing for such a climate change surprise calls for even greater efforts to build resiliency into our water use patterns and institutions.



However fast these changes occur, "no-regrets" actions that make sense now and in any of several different possible futures present real opportunities. The efficient use of water, coupled with attention to the fate of the saved water, agricultural practices that conserve soil moisture and require less irrigation, less energy wasted on unnecessary heating and pumping, and similar actions will help present and future generations and help reduce some of the causes of the climate change itself.

## DECISIONMAKING PROCESSES

### *A Long, Wide, Collective View*

A least-cost, end-use approach is one commonsense way to address a resource need. In its simplest form, one determines the real end-use, compares all of the ways to accomplish that end-use, and picks the cheapest. If efficiency is evaluated on equal terms with other options, it very often surfaces as the most cost-effective measure. This approach can be refined and made more rigorous and meaningful in a series of increasingly difficult steps.

1) The easiest refinement is to shift the focus from water to water-related services — what is actually needed are flushed toilets, clean clothes, and profitable farms and ranches rather than water per se.

2) Next, the cost analysis should be broadened to encompass whole-system costs — things such as energy, labor, and environmental mitigation. Basin-wide planning helps here.

3) In a similar way, the planning horizon for costs and end uses should be extended as far into the future as possible — a long-term view in spite of political changes every two to four years.

4) Most difficult is the task of determining the desired individual and community lifestyle or living conditions for which the water-related services are being sought. Questions arise about the need for lawns in desert cities, desirable human settlement and land-use patterns, appropriate scale and types of agriculture in arid regions.

Genuine public involvement in decisionmaking is essential throughout this type of process, but especially critical in the last step. Many water management agencies are making great strides in seeking public involvement at earlier stages of the planning process, but involving the public from the very beginning — as is the philosophy of true public involvement — can be very time-consuming and tedious. The challenge is to find ways to include all appropriate stakeholders in a genuine but efficient manner.

# CONCLUSION

## *What Questions Should Be Asked?*

*Asking the appropriate questions is essential in the pursuit of sustainability. Some questions regarding efficiency and the context in which efficiency should be addressed follow.*

### MUNICIPAL EFFICIENCY

1. How can we ensure that efficiency is considered as an equal option whenever new or expanded supply and treatment facilities are suggested?
2. Can we finance efficiency in the same ways as major construction projects? If not, how else?
3. What mechanism would allow us to determine the uses to which saved water is put?
4. How can we promote behavioral changes in water use (lawns & other habits) as effectively as we have with the use of new technologies, but without being preachy?

### AGRICULTURAL EFFICIENCY

1. How can we streamline legal and engineering mechanisms to determine the actual amount of water "freed up" by irrigation efficiency and identify any third-party injuries?
2. How can irrigators be rewarded for efficiency by allowing them priority rights to the saved water? Does society want this? If so, what is standing in the way?
3. Who stands to benefit from irrigation efficiency? Will they invest in it?

### COLLABORATIVE EFFORTS

1. Opportunities for collaboration abound: Do we have confidence in our institutions to ensure economic, environmental, and social sustainability of moving saved water from farms to cities, or between other uses? If not, what changes are needed to develop that confidence?
2. Once we have sufficient confidence in our ability to make good decisions on water transfers, what legal and bureaucratic barriers must be removed? How?

### FUTURE CHALLENGES

There is much to do— a priority system might help. Based on the following questions, and giving higher marks to actions that meet the greater number of criteria, what should be our priority actions?

1. Will this action address one of today's most critical needs? (eg., water quality)
2. Will this action help meet challenges we are quite sure are in our future? (eg., higher energy prices)
3. Will this action play out well in an uncertain future? (eg., a drier or wetter climate)
4. Will this action help slow or stop trends which are leading to a less desirable future? (eg., greenhouse gas emissions)

### DECISIONMAKING PROCESSES

1. How can we make genuine public involvement in water management decisionmaking efficient enough that it is readily adopted by utilities, governments, and others?
2. Should we more deliberately answer the fundamental questions surrounding efficient water use such as what land use and human settlement patterns do we want, should we have lawns in deserts, where is irrigation appropriate or not, how much water does the environment need? If so, who decides and how?

### FINAL QUESTIONS

1. Do we want water priced at its real cost? If so, what costs are included and how fast should we make the change?
2. How do we best use the time "bought" by efficiency to develop more sustainable water management strategies?
3. What longer-term education is needed to lay the foundation for sustainable water management in the future?



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