

## Chapter 10

# TOWARD A SUSTAINABLE WATER SUPPLY: TOOLS AND OPPORTUNITIES

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Solutions to water supply problems generally fall into two categories: reducing demand and increasing supply. There are a wide variety of tools available and opportunities to consider within each category. Choosing which options are appropriate for a particular region, community or water provider will depend on the nature of the problem as well as a number of feasibility factors, including available resources and political and social considerations.

When considering a community's water needs, population forecasts, current and projected per capita residential consumption and non-residential sector needs should be taken into account. Moreover, the mix of uses, *i.e.*, industrial, commercial and residential, can dramatically alter the amount and patterns of water use.

Water shortages are caused by demand in excess of supply and can be addressed by enhancing supplies, reducing demand or a combined approach. Whether the problem is seasonal, drought-related or a long-term imbalance between demand and supply, the nature of the shortage affects the selection of solutions.

Short-term water shortages are less costly and easier to address. For example, a temporary water shortage, whether caused by drought, equipment failure, poor water quality or the need to meet peak demands on a seasonal basis, could be addressed through conservation, system improvements, water hauling or the temporary acquisition of a new water supply.

On the other hand, overcoming water shortages that result from population growth is more costly and requires long-term planning and long-term solutions, *i.e.*, new facilities, significant conservation investments and additional water rights). Rapidly growing populations in many areas of Arizona, combined with increasing demand for water for recreation, aesthetic values and

fish and wildlife habitat, have resulted in a growing need for additional water along with more efficient use of existing supplies.

There are numerous options available to reduce the demand for water. Water conservation efforts aimed at reducing residential, industrial and agricultural consumption of water have been implemented in the state's five Active Management Areas (AMAs). Outside of the AMAs, conservation has been mandated by some local jurisdictions. In other jurisdictions, voluntary and/or education programs have been implemented.

## **DEMAND REDUCTION OPTIONS**

### **System Improvements**

- **Leak Detection and Repair:** Repairing leaks in pipelines, canals, water treatment and storage and delivery systems often yields substantial water savings.
- **Minimize Waste:** Engineering improvements to treatment and delivery systems can minimize water loss. For example, reducing the pressure in the system is one means of limiting losses.
- **Metering:** Metering or measuring water use can reduce demand even in the absence of a conservation-oriented billing system. This often results in better monitoring to avoid leaks and raises awareness of water use by consumers

### **Customer and Resident Programs**

- **Educational Programs:** Public education programs that advise residents about the limitations of available supplies, the implications of personal decisions about water use and options for reducing demand are important components of any water conservation program. These programs could include information about low flow plumbing fixtures, proper utilization of xeriscape landscaping principles, water harvesting, gray water use and irrigation system maintenance.
- **Incentive Programs:** Programs that create financial incentives for adopting water conservation measures help increase the likelihood that residents will implement and utilize water saving techniques. Reimbursements for low flow plumbing fixtures or landscape retrofit to lower water use plants are examples of such programs.
- **Assistance Programs:** Direct assistance can be provided to water users to help implement water saving measures such as irrigation scheduling assistance, advice about how to incorporate low water use vegetation into the landscape or audits of water use on residential and commercial properties.

### **Regulatory Controls**

- **Drought Restrictions:** Typical drought restrictions include limiting the hours that water can be used for domestic irrigation, car washing or other outdoor activities. More dramatic restrictions, such as prohibitions on outdoor watering, are generally implemented only in emergency drought conditions.
- **Conservation Ordinances:** Local conservation ordinances can be established to limit the quantity of water used for specific purposes or to ban certain high water use practices. For example, local ordinances have been adopted that restrict the amount of grass permitted in new developments, *e.g.*, golf courses, municipal easements and the common areas of residential communities, the types of landscaping and the use of misting systems.

### **Economic Signals**

- **Incremental Pricing:** A tiered rate structure or a conservation surcharge imposed by the water provider can be used to encourage lower water use.
- **Differential Hook-Up Fees:** The fees charged to hook-up a home to water service can be reduced in exchange for an agreement to incorporate water saving measures into the home's design, *i.e.*, limit turf, low flow fixtures *et cetera*. Meter size also can be used to limit the total water available to particular developments or lots.
- **Drought Penalties and Surcharges:** Pricing mechanisms can be used to reduce water use during drought conditions, focusing on higher water users in a system or those that do not meet required reductions.

## **SUPPLY ENHANCEMENT OPTIONS**

### **Local Supply Enhancements**

- **Surface Water Diversions:** An application to divert surface water can be filed with the Arizona Department of Water Resources (ADWR). However, most surface waters in Arizona are fully appropriated and it is likely that downstream water users will object to new applications.
- **Groundwater Pumping:** ADWR regulates the construction of groundwater wells in Arizona. The Department requires a Notice of Intention to Drill be filed for all wells outside AMAs. Within AMAs, a water right is required in addition to obtaining authority to drill a well. Availability of groundwater varies dramatically based on the geology of the area.

### **Effluent Use**

- **Reclaimed Wastewater System:** Reclaimed water is highly treated wastewater that can be utilized for turf and landscape irrigation, *i.e.*, golf courses, parks and play-

grounds, thereby reducing the amount of potable water needed. It also is suitable for some industrial uses, particularly for cooling towers.

- **On-Site Gray Water Use:** Gray water is wastewater collected separately from sewage flow. Its use is restricted to the property from which it originated. Gray water sources include clothes washers, bathtubs, showers or sinks but not the kitchen sink, dishwasher or toilet. Using gray water can decrease the amount of potable water used for irrigation. There can be water quality issues associated with the use of gray water; guidelines established by the Arizona Department of Environmental Quality (ADEQ) govern its use.
- **Water Purification/Potable Use:** Poor quality water can be purified to increase its utility. Reclaimed water that is treated to potable standards and used directly as potable water can provide a ready supplement to existing supplies. However, direct potable use is uncommon.
- **Recharge and Recovery of Effluent:** Effluent is water treated at a municipal treatment plant prior to being discharged. So long as the effluent meets appropriate water quality standards established by ADEQ, it could be used to recharge aquifers, thereby reducing the risk of subsidence and enhancing groundwater supplies.

### **Import Water**

- **Temporary Transfers:** A temporary water transfer involves paying for the use of water rights on a temporary basis. This type of transaction typically occurs when farmers opt to fallow their land and lease their water rights to a nearby community. Although uncommon in Arizona, temporary water transfers have been used to address short-term water needs in many states. Water markets have emerged in some states to facilitate this process; a governing body typically runs such markets.
- **Outright Purchase:** Because most groundwater rights in Arizona are not easily separated from the land (the ability to do this is affected by whether the land is within an AMA or not), a permanent water transfer generally involves the purchase and retirement of agricultural land for its water rights to be used by non-agricultural interests.
- **Dry Year Options:** This approach can be utilized when a community has an adequate water supply in most years, but is confronted with a water shortage in the driest years. Dry year options generally require a community or other water user to pay a flat sum of money for the option to purchase water when it is needed. When the option is exercised, the community pays an additional charge for the actual water usage, generally by the acre-foot. This tool is being used increasingly in other western states, but there are institutional limitations in Arizona.

### **Water Storage**

- **Distribution System Storage:** Increasing water storage capacity can enhance the ability to meet peak demand.
- **Underground Storage:** The availability of groundwater aquifers that are conducive to artificial recharge depends entirely on the local hydrology. Opportunities to utilize underground storage should be fully explored since artificial recharge is both legally and physically complex.
- **Surface Reservoirs:** Most surface reservoirs in Arizona are man-made and opportunities for new reservoir construction are limited by geographic and environmental conditions and regulatory requirements.

### **Other Water Supply Options**

- **Water Harvesting:** Capturing water on a property for reuse can create a new supply of water while decreasing demand for potable water on the site. Water harvesting is especially useful for landscape irrigation. Water harvesting can be “passive,” meaning that the water delivery occurs through gravity alone, or “active,” including pumps and more complex systems. Some water harvesting systems include storage for future use, while others involve land contouring to direct water to plants or retention areas.
- **Watershed Management:** Decreasing the number of trees and shrubs in a natural watershed may increase the amount of water available for other uses. There are controversial aspects to thinning or removing vegetation for water supply purposes, including debate about the effectiveness and environmental implications of such techniques.

## **SUMMARY**

Once viable water management options have been explored, they should be carefully evaluated to identify the legal, financial, political and social ramifications of each alternative. Relevant criteria for evaluating options include: costs, *i.e.*, capital and operational costs over the short and long-term; the reliability and risks associated with new supplies; potential environmental and social impacts; and identification of relevant institutional or legal constraints.

Voluntary programs such as educational, incentive and assistance programs can often be implemented quickly; however, the results can vary and have only a temporary effect. A recent study (Woodard, Weber and Stewart, 2004) conducted in the metropolitan Tucson area indicated

that over 60 percent of the surveyed households reported at least one type of water reuse activity. Among those that did not reuse water, the top reasons given were “we don’t know how” and “need help” followed by “not worth the cost,” “unsafe,” and “not worth the trouble.”

Before serious consideration of any alternative advances, it is wise to consider how and when affected communities can provide input to the decisions makers. Failure to engage stakeholders early on can result in unnecessary costs, delays or significant political limitations on the ability to solve water problems.