

WATER CONSERVATION MEASURES FOR SHORT AND LONG-TERM WATER DEMAND REDUCTION

Laurie E. Ashmore

AUTHORS: Brown and Caldwell, Consulting Engineers, 32 Perimeter Center East, Suite 120, Atlanta, GA 30346.

REFERENCE: *Proceedings of the 1989 Georgia Water Resources Conference*, held May 16 and 17, 1989 at The University of Georgia. Kathryn J. Hatcher, Editor, Institute of Natural Resources, The University of Georgia, Athens, Georgia, 1989.

INTRODUCTION

Consistently meeting demands can prove to be a difficult task when dealing with a finite resource like water. There are incidences when water demand reduction is a viable alternative to increasing water supplies. This demand reduction can be accomplished by various water conservation measures.

The implementation of water conservation measures can be for short-term or long-term demand reduction. Short-term demand reduction is applicable in response to specific water supply deficits such as the summer droughts experienced in recent years. Long-term demand reduction has the potential to reduce water demands into the future. When planning for future water needs, long-term conservation can significantly reduce capital expenditures for new facilities.

This paper presents both short-term and long-term water conservation measures. In addition, the integration of these measures in drought management and long-range water supply planning is discussed.

LONG-TERM WATER CONSERVATION MEASURES

Water conservation has been defined by the U.S. Water Resources Council as "activities designed to (1) reduce the demand for water, (2) improve efficiency in use and reduce losses and waste of water, or (3) improve land management practices to conserve water." There are a multitude of water conservation measures available to a community. However, the myriad of options must be narrowed down by evaluating the measures with regard to water savings, cost, reliability and feasibility. Generally, water conservation measures can be categorized as either pricing, regulation, education, or hardware.

Pricing

The price the consumer pays for water can have a significant effect on the amount of water used. The declining block rate structure encourages the use of water. Typical rate structures for water conservation are based on three types of pricing: flat rates, seasonal pricing and inclining block rates.

1. Flat rate water pricing applies the same unit charge for water regardless of the quantity consumed.
2. Seasonal pricing involves a higher rate during the peak seasonal demand period to meet the capital costs associated with the expanded facilities necessary to produce peak demand capacity. These increased rates influence customers to reduce water use to lower their more costly water bills.

3. Inclining block rates apply progressively higher rates to each increment of water used above some base amount. This method encourages customers to save water, and frugal customers will benefit from lowered rates.

The effectiveness of these types of price structures as water conservation measures will depend on demand price elasticity. Price elasticity is the ratio of the change in water use to the change in price. Values of price elasticity vary widely in the literature. Specific price elasticity must be determined for a service area by examining the effect of price increases on demand.

Monetary incentives may be used to enhance compliance with water use restrictions. Excess use charges can be implemented which impose stiff charges for water used above the rationed allotment. Fines can be levied against customers who do not comply with bans.

Regulations

Regulations requiring water conservation can take many forms and include (1) requirements for new construction, (2) water use restriction, and (3) rationing.

Low water use fixtures are required by Georgia law. Communities may adapt requirements for the newer fixtures which use even less water than the fixtures currently required.

Restriction of water use, such as odd-even outdoor watering restrictions, have become a commonly used water conservation measure during recent drought years. Restrictions can take many forms, depending upon the desired water reduction, and the water use pattern of the service area. Ordinances may also be enacted which ban water waste, hosing hard surfaces, etc.

Water rationing is a severe, but very effective, water conservation measure. The reduction percentages required can be constant, stepped, or variable. In implementing water rationing, it is important that the program be perceived as equitable. Percentage reductions may be perceived as inequitable because identical houses could receive vastly different allocations. A fixed water allowance per capita may be perceived as more equitable.

Education

The habits, attitudes, and decisions of the retail customer with respect to water use dictate the demands placed on a water system. To be effective, a water conservation public education program must consider the retail customer's viewpoint.

An effective public education program needs goals, a commitment of resources, and a theme. The program must be honest and convincing when addressing the issue of why

the public is being asked to conserve. The public must perceive the immediate need for conservation.

The most cost-effective means of communicating with the water user should be used. Some of the methods used in water conservation programs elsewhere include: (1) direct contact with customers, (2) mass media, (3) in-school training, (4) speakers' bureaus, (5) information booths, and (6) participatory campaigns.

In addition to the general public education program targeted at all customers, specific program elements can be targeted at residential and or commercial large water using customers. A home water survey, where the customer has one-to-one interaction with a water conservation specialist, can result in significant reductions in both indoor and outdoor water use. The survey can include (1) checking for leaks, (2) furnishing water-saving devices, (3) providing advice on proper lawn care and developing a lawn irrigation schedule, and (4) advising homeowners on household specific conservation measures. Guidelines can be developed for outdoor landscaping in order to reduce water demands. In North Marin County, California, homeowners are given incentives to reduce landscape water use, such as by reducing the perimeter of turf to the area of turf used in a landscape. This incentive program is working well for multifamily residential developments.

The non-residential landscape water audit is a proven technique for obtaining outdoor water savings. The objectives of the audit are to improve irrigation uniformity, improve irrigation scheduling and intensify turf maintenance. In some cases water use has been reduced as much as 30 percent.

Hardware

Water conservation measures that are hardware devices for use can be divided into two groups, those used in new construction or remodeling, and those devices which modify or replace existing fixtures to decrease their water usage. This modification of existing fixtures is commonly referred to as retrofitting.

Water saving devices for new construction are available that have reduced water requirements while maintaining the function of more water consuming devices. Low- and ultra-low flush toilets are available that save 2 to 4 gallons per flush over a standard toilet. Reduced flow shower heads and faucets are available which reduce the flow rate while maintaining the rinsing abilities of standard fixtures. Water efficient clothes-washing machines reduce the water requirements by 5 to 6 gallons per load compared with standard appliances. If all of these water saving devices were installed in a new home, water saving could total 18 to 26 gallons per capita per day.

Existing homes can become more water efficient through the use of retrofit devices. Toilets can be modified to reduce flush volume by the use of toilet-tank displacement bottles, water-closet dams, or toilet tank bags. Toilets can also be checked for leaks and if they are leaking, up to 24 gallons per toilet per day can be saved by replacing leaky ballcocks and flapper valves. Showers can be made more efficient through the use of a flow restrictor or by replacing the existing shower head with a reduced flow shower head. Faucets can be fitted with aerators with flow control. Retrofit kits containing two low flow shower heads, two toilet tank displacement devices, leak detection tablets, and instructions are available for distribution to homeowners. When the kits are installed, approximately 11 gallons of

water per capita per day may be saved. The savings from a retrofit program are dependent upon installation. Distribution and follow-up should be designed to assure the maximum number of devices are installed. San Jose, California has achieved an 85 percent installation rate for these devices, resulting in an overall savings of 9 gallons per capita per day. In a large area like San Jose, where 200,000 homes have been retrofitted, they have reduced water use and wastewater flow by 6 mgd.

WATER CONSERVATION FOR SHORT-TERM DEMAND REDUCTION

In order to determine the actions required during a period of water shortage, a six-step planning process, such as the drought management process illustrated in Figure 1, is normally undertaken. In Step 1, supply and demand data are collected to determine how much water of acceptable water quality will be available under various crisis condition. Steps 2 and 3 involve assessing water supply augmentation and water demand reduction options and setting triggering levels for moving to a more or less serious phase. Step 4 represents the synthesis of information from previous steps. Groups of water-saving measures are associated with progressive phases of water shortage. Plan implementation is considered in Step 5. Step 6 represents the continuous monitoring of program results and the adjustments of water shortage phase.

Typically, plans for dealing with water shortages consist of three phases, for moderate, severe, and critical shortages. Water use reductions for these progressively more severe shortages are 10 to 20 percent, 10 to 20 percent, and 20 to 35 percent, respectively. The actions required for this plan to become effective normally increase from voluntary, to restrictions on use, to allocation or rationing.

Water restrictions and rationing are water conservation measures with the immediate effectiveness required in dealing with a short-term water shortage. In addition, several quick and effective ways to achieve residential and non-residential water saving savings are:

<u>Measure</u>	<u>Potential Water Savings</u>
Residential retrofit	12 percent of indoor use
Residential water survey	5 percent of indoor use and 25 percent of outdoor use
Non-residential retrofit	25 percent of indoor use
Non-residential audit	25 percent of outdoor landscape water use
Non-residential process audit	10 to 25 percent of process use

COST-EFFECTIVENESS OF WATER CONSERVATION

Utilities can achieve great benefits when they consider water conservation as part of their long-term water management programs. A program of compatible water conservation measures has the ability to reduce water demands in the

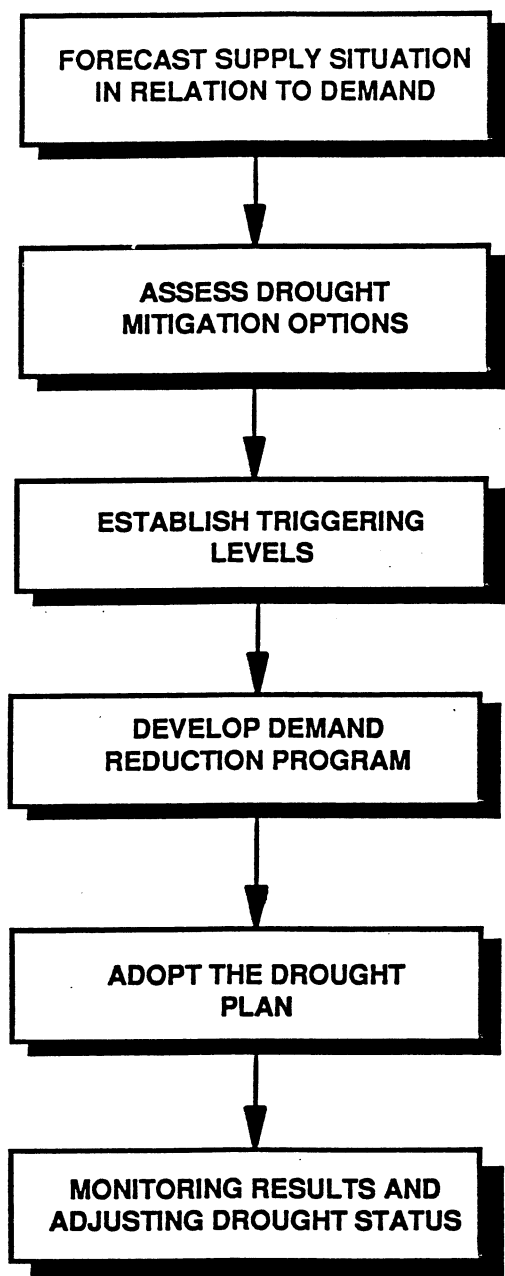


Figure 1. Drought Management Steps

service area, thereby delaying, or reducing the need for additional supply, or other capital intensive needs.

Water conservation measures can be evaluated for their cost-effectiveness in a given service area. A long-term program would then be developed which included the measures with the greatest benefit to the community for the lowest costs.

In order to compare water conservation with other water supply measures, it is necessary to put all water supply alternatives on a consistent basis, such as cost per volume of water saved (or provided). In general, it is less costly to reduce demand through conservation than to satisfy increased demand with additional supply.

CONCLUSIONS

Water conservation can be an integral part of effective water resource management, both as a water shortage response and as a long-term strategy. As we work toward managing water shortages, and ever increasing demands on Georgia's water resources, we should consider the potential of water conservation in our water supply planning.

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