

# DEMAND REDUCTION IN RESPONSE TO DROUGHT: THE CITY OF SANTA BARBARA EXPERIENCE

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From 1986 to 1992 the City of Santa Barbara faced its most severe water shortage to date. A critically dry period, coupled with the inability to pursue planned supply improvements, resulted in shortages of as much as 45% during 1990. Shortages were projected to be as high as 80% for subsequent years had the drought continued. However, the drought was eased with substantial rainfall in 1991 and terminated following substantial rainfall again in 1992. This paper outlines the measures taken to reduce demand during the drought, evaluates the effectiveness of the measures, and comments on policy issues associated with demand reduction during drought.

## Background

The City of Santa Barbara owns and operates its own municipal water supply, serving approximately 90,000 people. The service area is primarily residential, with about 75% of the water provided to residential customers. Typical demand before the recent drought was approximately 16,300 acre feet per year (AFY). On average, about 90% of the water supply comes from the Santa Ynez River, located just beyond the coastal mountains of Santa Barbara. The City owns a small reservoir on the river (Gibraltar Reservoir) and shares supplies from a larger regional reservoir downstream at Lake Cachuma. Historically, the balance of the water has come from groundwater. Dry periods are often followed by a year of heavy rainfall that fills the reservoirs completely in one season, a point that was significant in terms of drought response efforts.

Water supply planning efforts in 1985 revealed the impending shortfall between available supplies and the demand for water. A Master Water Plan identified the enlargement of Gibraltar Reservoir as a feasible means of augmenting the City's water supply. Efforts to complete the enlargement were delayed by litigation from downstream interests. Eventually the project was put on hold indefinitely due to an endangered species habitat in the area which would be inundated. A five-year action plan was adopted to resolve the disparity between supply capability and projected demand. It was at this time that the drought overtook the City and the response perspective shifted from the mid-term to the short-term.

## Early Drought Response Efforts

When the regional reservoir, Lake Cachuma, reached the half empty point in 1988, the City began to actively plan for the possibility that the drought could continue to the point of causing drastic shortages. At the same time City officials realized that the drought might be terminated at any time by a wet season comparable to 1983, 1978, or 1969. This fact colored decision making regarding imposition of water use restrictions and investment in emergency water supply projects.

A Drought Contingency Plan was adopted in November 1988, outlining three stages of drought response and corresponding strategies for each stage. The stages were to be triggered at shortages of 10%, 15% and 20%, respectively. An implementing ordinance specifying water use regulations during drought was adopted in February 1989. This was a very useful, yet somewhat incomplete, effort to prepare for the major dislocations of a possible water shortage emergency. Useful, because it addressed those issues that could be anticipated and because it allowed debate and modifications prior to the heat of crisis. Incomplete, because it did not clearly define the criteria for entering the various stages (nor did it address at all the criteria for leaving the stages after the drought) and failed to foresee some important issues related to water use regulations and rate impacts as discussed below.

With this planning effort completed and another year of below-average rainfall almost over, the City acknowledged a 10% projected shortage and moved to a Stage I Drought Condition in March 1989. In accordance with the Drought Contingency Plan, this was intended as a "wake-up call" to inform the public that an acute water shortage was developing. Its primary element was a request for a voluntary reduction of 10%, compared to the previous year's usage. Water bills had previously been formatted to show the previous year's usage and the percentage of a year ago. Due to the voluntary nature of the requested cutback, there were not significant concerns about the inequity of basing reductions on historical consumption. A public information effort was initiated to help put the message out. The response was right on target. Somewhat coincidentally, during the summer of 1989, the City was implementing an inverted block rate structure as a part of the long-term effort to match supply and demand. The new rate structure went into effect in July 1989.

The summer and fall of 1989 were spent planning for the possibility that the winter of 1990 would be another dry one. Decision points regarding upgraded drought conditions were established. In the absence of significant rainfall, Stage II was to be declared in January 1990. Stage III was to be declared if the dry pattern still had not been broken by May 1990. In fact, the winter was so dry that Stage II occurred in January and Stage III was declared six weeks later in February 1990.

## The Stage III Program

Reductions of 10% and more had been accomplished during Stage I. At the start of Stage III, water supply projections showed shortages of 45% in 1990, 55% in 1991, and 80% in 1992 if below-average rainfall continued. Lake Cachuma would have been empty by 1992 under these projections. In addition to a major effort to secure new emergency supplies, which lead to construction of a 7,500 AFY seawater desalination plant, the City instituted a broad-based effort aimed at reducing demand by 45%. The demand reduction program addressed water rates, water use regulations, development restrictions, incentives for efficiency improvements, and public information.

As noted above, a block rate billing system was being implemented as a part of the City's long-term water conservation program at the time the drought emergency was developing. For residential customers, allotments were the same for each dwelling unit in a particular residential class, rather than basing allotments on historical usage for each account. This was done

Table 1. Comparison of Water Rates

Customer Class	Pre-Drought Rates	Original Stage III Rates	Current Rates
Single Family Resid.	8 hcf @ \$1.09 12 hcf @ \$1.58 20 hcf @ \$1.97 41+ hcf @ \$3.01	4 hcf @ \$1.09 4 hcf @ \$3.27 6 hcf @ \$9.81 15+ hcf @ \$29.43	4 hcf @ \$1.85 36 hcf @ \$3.70 41+ hcf @ \$5.10
Multi-Family, 5+ Units (Per dwelling unit)	5 hcf @ \$1.09 2 hcf @ \$1.75 2 hcf @ \$2.09 10+ hcf @ \$2.65	4 hcf @ \$1.09 1 hcf @ \$3.27 1 hcf @ \$9.81 7+ hcf @ \$29.43	4 hcf @ \$1.85 5 hcf @ \$3.70 10+ hcf @ \$5.10
Comm./ Industrial	Base hcf @ \$1.40 Peak hcf @ \$5.51	70% of Base hcf @ \$1.40 All other @ \$8.40	Base hcf @ \$3.70 Peak hcf @ \$5.10
Monthly Service Charge - 5/8" Meter	\$1.47	\$1.47	\$3.70

to avoid the inequity of granting higher allotments to customers who had not been making efforts to conserve water in the past. In general, this approach was carried forward during the drought. A temporary exception for large households allowed an allotment based on the number of

permanent residents, provided that the residence was retrofitted to comply with plumbing efficiency standards. A pre-drought provision allowing increased water for residential irrigation on large lots was rescinded during the drought, meaning that large lots had the same allotment as smaller lots.

With the move to Stage III, the rate structure was altered significantly to help achieve the required demand reductions and to maintain sufficient revenue.<sup>1</sup> A comparison of rates for several customer classes before and during Stage III is shown in Table 1. In the residential sector, the steep incline in rates reflected the greater amount of discretionary use, particularly for lawns and other landscape watering. It was acknowledged that commercial water use is less elastic because water usage is often directly related to the level of business output. Accordingly, the cost increase for water in the upper block was not as steep as in the residential sector. Conversely, this sector did not enjoy the low-priced "baseline" allotment that was provided to residential customers at below the City's average cost of production. As a warning, a notice was sent to each customer at the start of Stage III, showing a calculation of what the new water charges would be for the amount of water used by the customer during the previous month.

In addition to severe water rate modifications, the City instituted the water use regulations shown in Table 2. While the regulations were adopted to help meet the savings goal of 45%, they were also viewed as a means of spreading the burden of the drought over all customers, not just those who could not afford the high cost of water. The City hired two Drought Enforcement Officers (popularly known as "water cops") to enforce the regulations. Violators were subject to fines of up to \$250, though most of the 189 citations issued were for first offenses, resulting only in a warning. A review process allowed citizens to appeal citations.

The most significant of the regulations was the lawn watering ban. It is significant to note that the Drought Contingency Plan listed the prohibition of *all* landscape watering as a strategy to be employed during Stage III. There was serious discussion of implementing the regulation in this manner, but an informed and well-organized proposal from the landscape industry convinced City officials to attempt to meet the savings goal using the less onerous restriction shown in Table 2, which allowed watering of trees and shrubs, but not lawns.

Development restrictions were already in place in recognition of the long-term water supply deficit. When the shortage became acute, there was pressure to cease issuance of even the limited number of building permits that were being processed. As a concession to property owners who were trying to move ahead with projects, an "Off-site Retrofit Program" was established. Under the program, a development project could move ahead if the projected water usage for the project was saved through the installation of 1.6 gallon toilets in other properties in the City. The retrofit of the toilets was paid for by the owner of the property that was to be

developed. A two-to-one ratio of savings to projected water use was required for residential projects, and three-to-one for commercial projects.

The City used incentives where possible to help achieve the required demand reduction. Besides the obvious incentive of avoiding high water charges, the City continued to issue rebates of \$80 for the retrofit of older toilets with 1.6 gallon models. The number of toilet retrofits climbed from less than 100 per month to over 2,500 per month at the peak of the Stage III program. The free low-flow showerhead program continued, with approximately 35,000 showerheads distributed to City water customers by the end of the drought. Certain rate exemptions were allowed if plumbing fixtures were retrofitted to meet current efficiency standards for new construction. During the course of the drought a variety of educational literature was developed for use by customers. As it became clear that savings goals were being met, the role of the "water cops" was shifted from enforcement to customer assistance.

Table 2.

Water Use Regulations During Stage III

- ▶ Hosing of paved surfaces and buildings prohibited, except for health and safety reasons;
- ▶ Restaurants required to post drought notices and refrain from serving water except on request;
- ▶ Fountains required to be equipped with a recirculation pump and a sign stating that recycled water is being used;
- ▶ Hotel/motels operators required to post drought notices in each room;
- ▶ Run-off prohibited;
- ▶ Use of reclaimed water required for construction activities where deemed feasible by the City;
- ▶ Addition of water to swimming pools prohibited (later modified to allow addition for pools equipped with a cover);
- ▶ Irrigation of turf generally prohibited; drip or low-volume irrigation required for trees and shrubs;
- ▶ Car washing allowed only at commercial facilities equipped with water recycling equipment or by use of bucket and automatic shut-off nozzle.

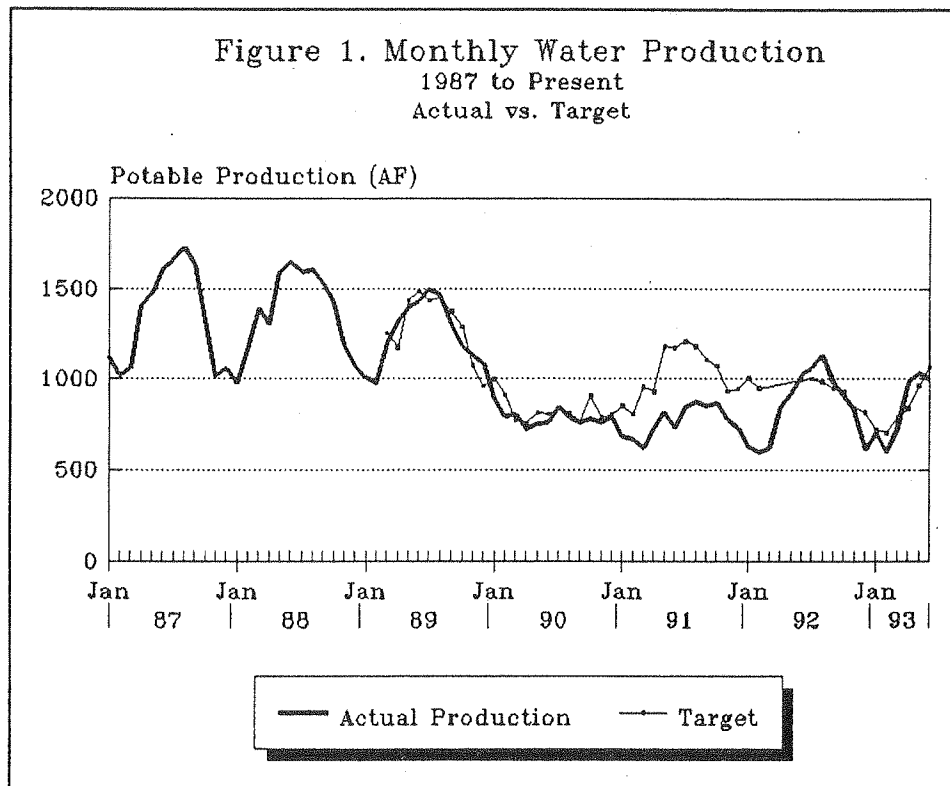
The final component of the Stage III program was the public information campaign.<sup>2</sup> The City used the services of a variety of public information consultants, with varying levels of success. Water bill inserts were used monthly to provide up-to-date information to customers. A special rate notice warned customers of the severely altered rate schedule. Print, radio, and television advertisements were purchased. A "Drought Awareness Fair" was held to raise awareness and teach water conservation techniques.

Direct mail newsletters were employed so as to reach all citizens, rather than just those who received a water bill insert. The most powerful tool for public information consisted of the editorial positions and news reporting by the local daily newspaper, over which the City had little control. Accuracy of coverage varied widely depending on the reporter assigned to cover the events.

### Evaluation and Commentary

The following points are offered as a summary and evaluation of the program and as a discussion of policy issues associated with demand reduction during drought.

- Demand was effectively reduced, with a good match between actual demand and target demand, as shown on Figure 1. The exception was the period during 1991 when some relief had been provided by the "March Miracle" rains, but the drought was not officially over and rates remained high. This caused reductions to exceed the target



requested by the City. This is evidence that the move out of a drought is an entirely different exercise from the move into a drought. On the way in, demand was reduced sharply, but recovery of demand has been a slow process. Indeed, the City projects that a return to near pre-drought levels will not occur until 1996. This has important implications for revenue projections, particularly because the Water Fund budget doubled during a time when sales were reduced by half.

- Reductions by sector conformed with expectations. Single-family residential usage declined by about 56% compared to approximately 20% in the commercial sector. Multi-family residential usage declined by about 41%. This could be a reflection of the lawn watering ban, since lawns are much more prevalent at single-family residences. It could also be an indication of the higher level of discretionary usage associated with residential customers in general, and single-family homes in particular.

Analysis of City-wide wastewater flows helped determine the extent of indoor versus outdoor water use reductions. Average wastewater flow dropped from 9 million gallons per day (MGD) to 6 MGD, suggesting that approximately 45% of the demand reduction came from reductions in indoor water use.

- Public information efforts overall were successful, as indicated by the largely positive response on the part of the public. In the beginning there was a deficiency of public information about the City's efforts to resolve the crisis by obtaining new supplies. The lesson is that citizens wanted to hear what the City was doing to handle the situation, as well as being told what was expected of them. The multi-departmental public information task force provided broad expertise and increased support for the public information effort. City staff concurred that the direct mail newsletter was the most effective tool for getting good information out to all the citizens. Public relations consultants provided a useful reminder for staff to translate technical information into terminology the public could understand. However, staff spent a good deal of time educating consultants about the technical aspects of the water supply system.
- A number of policy issues arose in regard to the rate program. The previously mentioned exemption for large households was considered necessary to insulate large families from the steeply inclined block rates. With regard to allotments for large residential lots, there was debate among staff as to whether there should have been an extra allotment for particularly large lots. Those opposed took the position that each home should have the same allotment. The minority opinion was that there should be some additional allowance to recognize additional legitimate irrigation needs, even during a drought.

Once the Stage III rates came into effect, it became apparent that some sort of relief from the high charges would be appropriate in cases of water line breaks or other extraordinary and inadvertent water usage. The City adopted a policy of granting relief of the penalty portion of the charges on usage that exceeded recent historical consumption, if it appeared that the high usage was beyond the reasonable control of the customer. Even if granted relief, the

customer was still obligated to pay for all the water in question at the second block rate, which represents the City's average cost of production.

In summary, the block rate billing system has proven to be a useful and flexible tool for shaping demand under a variety of water supply conditions, despite the policy problems that arise whenever there is an attempt to specify how much water is an "appropriate" level of usage for various types of customer.

- In retrospect, many staff felt it may have been better to rely solely on water rates and public information to achieve the necessary reduction in usage, without "micro-managing" the situation by imposing water use regulations on citizens. There seems to be concurrence that the required reduction could have been achieved without regulations. However, those who still support the use of regulations believe that equity was served by using the regulations to require all persons to make some sacrifice during this extraordinary period. It was also felt that allowing lawn watering would send an inconsistent message during a time when a water shortage emergency and a state of disaster had been declared.
- In part as a response to recent experience with the drought, a revised long-term water plan has been developed. Included in the plan is a definition of the maximum acceptable shortage (10%) as one of the criteria for assessing the adequacy of the City's water supply system. The Drought Contingency Plan will be modified to reference specific levels of Lake Cachuma as triggering mechanisms for future drought response efforts. Specified lake levels will also be the indicators for starting and stopping the use of groundwater and desalinated water as back-ups for surface supplies during future droughts.
- The City's long-term water conservation efforts have received a boost as a result of the drought. While much of the reduction in demand is probably the result of temporary structural or behavioral changes, City officials believe that institutional changes have caused a substantial reduction in long-term demand as well. The long-term reduction will result from over 20,000 toilet retrofits, much wider use of low-flow showerheads, a substantial amount of conversion to drip/low-volume irrigation in response to drought regulations, and repair of leaks that might otherwise have gone unnoticed.

The cost of water, now about three times the pre-drought rate, is also expected to influence demand, at least for the short term. It is not clear that demand is elastic enough, at least in the recent range of prices, that the cost increase will be a permanent deterrent to pre-drought water use behavior. To the extent that it is not elastic, long-term reductions will result solely from institutional efficiency improvements as people slip back into old habits and accept the new



price of water as "normal."

The City's mid-term demand projections show demand returning to 15,000 AFY by 1996 as opposed to a return to the pre-drought level of 16,300 AFY. This rate of recovery is consistent with the experience of Marin County in California following the 1977-78 drought, except for the assumption that demand will level off before reaching the pre-drought level. This leveling represents the assumption that there have been significant permanent reductions in demand as a result of water efficiency improvements during the drought.

### Conclusion

The experience of the City of Santa Barbara during the recent drought is likely to be of use to other agencies experiencing water shortages. Staff of the City's Water Supply Development Division, Public Works Department would be pleased to respond to inquiries from other water agencies. The authors can be reached at the City of Santa Barbara, Public Works Department, P.O. Box 1990, Santa Barbara, CA, 93102, or by calling (805) 564-5460.

### Notes

<sup>1</sup> For further discussion of drought water rates and revenue impacts, see Mack, Stephen F. and Bill Ferguson, "Water Rates and Revenue Impacts of Severe Drought Response, City of Santa Barbara, 1990-1993", Conserv93 Proceedings, 1993.

<sup>2</sup> For further discussion of the City's public information program, see Whitney, Alison, "Evolution of Public Information During the Drought and Beyond", Conserv93 Proceedings, 1993.