THE IMPACT OF BEHAVIORAL FACTORS ON RESIDENTIAL WATER CONSERVATION

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EXECUTIVE SUMMARY

Municipal water agencies are periodically faced with water shortages that are temporary in nature. Such shortages tend to be caused by variations in rainfall or by excessive demand on pumping stations, and may or may not be related to more permanent water problems caused by changes in the patterns of population and industrial growth. In conditions of temporary water shortage, it may not be necessary to achieve either a permanent reduction in water consumption or a permanent increase in water storage capacity. Rather, it may be necessary to implement only a temporary decrease in normal water-use patterns to alleviate the shortage during the critical drought period.

A problem, however, is that little is known about how to implement procedures designed to reduce water consumption in the short term while avoiding the antagonization of the public. Water agencies tend to implement a whole series of actions simultaneously, making it impossible to identify the relative impact of each of the procedures. Carefully designed experiments, developed on a foundation of behavioral research, may provide the necessary information on how to reduce water consumption without creating resistance to the program. This study was an initial effort in establishing an understanding of the behavioral factors influencing water consumption. It tested the efficacy of several practical approaches that could be implemented by water agencies to achieve temporary reductions in residential water consumption during short-term water shortages.

The study was conducted in Stillwater, Oklahoma, where a temporary water shortage existed. The City Council had made a broad public appeal for residents to reduce water consumption by 10 percent, and this goal was used as the conservation target for participants in the study. Two hundred residences were randomly selected and assigned to the eight experimental and two control groups.

The research was conducted in three stages consisting of a pre-experimental stage, an experimental stage and a post-experimental stage. Information was gathered regarding attitudes, beliefs and values of the residential participants. Subsequently, the presence or absence of goal-related feedback, reminders, and conservation pledges were examined for their effects on the rate of water consumption during an eight week period. Water consumption was also evaluated for a three-month period following discontinuance of the experiment.

In general, it was found that these behavioral approaches can be effective in reducing the water consumption of residents during temporary water shortages. However, some combinations of the separate approaches are more effective than others and it is important that water

agencies understand what these are. Four significant findings were derived from the research.

Finding 1. Temporary decreases in water consumption, ranging from 14 to 24 percent, were achieved with the use of either goal-related feedback or informational reminders. Goal-related feedback is implemented by first setting a specific city-wide conservation target (10 percent in the present study) and then providing weekly feedback to residents regarding their actual rate of water consumption relative to the target. Alternatively, the weekly use of information reminders of the need to conserve, coupled with the city-wide conservation target may also achieve reduced consumption rates. (The weekly reminders asked the resident to conserve water and described several ways of doing so.)

It is important to realize that the combined use of both goal-related feedback and informational reminders was found to be ineffective and actually resulted in increased water usage. This unexpected finding was interpreted as resulting from participants being overloaded with information when they received both the feedback and the reminder. Consequently, they ignored the information and used water at the same rate as the control groups. The implication of this finding is that a city agency should implement the approach found to be more cost effective or practical given the city's billing and/or metering practices.

Finding 2. When residents were simply solicited for their commitment to conserve water, the commitments, by themselves, did not cause the residents to actually conserve. However, such commitments, or pledges, may be a necessary preceeding event which facilitates the goal-related feedback or the information reminders (see Finding 1). Assuming that the water agency can, and probably should solicit these pledges to the conservation effort (city-wide target), the manner in which the pledges are signed will be an important consideration in choosing between goal-related feedback and informational reminders.

The results of the study indicated that if the agreement decision was made by total "family units," informational reminders achieved greater conservation. However, if the conservation commitment decision was made by a single adult member of the family, goal-related feedback was more effective in achieving conservation.

The two findings mentioned above suggest an effection managerial process, for deciding which approach the water agency should use. The approach is labeled a contingent decision process. Thus, decision makers in a community should:

a. evaluate cost/benefit and other practical considerations to determine whether goal-related feedback or information reminders are most compatible within existing water agency procedures.

If goal-related feedback is more compatible, then

b. establish the conservation target and solicit residential pledges from a single adult member of the families, and

c. administer weekly goal-related feedback during the critical period of water shortage.

But, if information reminders are more compatible, then

b. establish the conservation target and solicit residential pledges from total "family units," and

c. administer information reminders weekly during the critical period of water shortage. At least one component of the reminders should relate to the importance of individual efforts in achieving community goals (e.g., conserving water).

Finding 3. Individuals who believed that the water shortage can be effectively solved by either their own efforts, or the efforts of a significant other (such as a weather modifier) were found to use less water than those who felt that the water shortage could not be solved. Therefore, an educational campaign that precedes the actual conservation program (goal-related feedback or information reminders) could alter residents' beliefs and enhance the program. In order to facilitate the belief that individual efforts can indeed make a difference, materials that explain various methods of saving water would be distributed. Widespread media campaigns could demonstrate the results in other cities where residents successfully coped with temporary water shortages through voluntary, individual, cooperative efforts. This educational effort, aimed at affecting individual beliefs, should precede the goal-related feedback or information reminders, in order to avoid the overloading effect of using too many approaches, simultaneously.

Finding 4. Participation in the study tended to either not influence (56.9 percent) or influence positively (43.3 percent) the feelings of participants about water conservation. Therefore, the use of behavioral factors, such as feedback and reminders can be implemented with minimal fear of a backlash by citizens.

In summary, this study has shown that municipal water agencies can use specific behavioral approaches during temporary periods of water shortage and achieve a reduction of water consumption ranging from 14 percent to 24 percent. These steps will likely be well received by residents and the conservation goals will likely be achieved without resorting to harsher approaches such as watering restrictions, rate changes or use penalties. When the water emergency is over, the use of goal-related feedback or informational reminders may be discontinued and normal consumption patterns will return. If the conservation target exceeds the 14 percent to 24 percent range, or if the water shortage is more permanent in nature, the behavioral approaches may not achieve the necessary goals.

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ABSTRACT

A complete factorial, field experiment was conducted to test the effects of three variables on water consumption of 200 randomly selected families. The families were either provided or not provided with weekly feedback of their water consumption. The families were either given or not given a weekly reminder of the need to conserve water. Either one adult or the entire family signed a pledge to reduce their water consumption by 10 percent. Two control groups were formed. One group received no experimental manipulation, but an adult member of the family completed a preliminary questionnaire assessing water conservation attitudes. (The eight experimental groups also completed the preliminary questionnaire.) Family members in the other control group were never contacted. The major finding revealed that either providing weekly feedback or providing weekly reminders reduced water consumption between 14.4 and 24.6 percent. However, providing both reminders and feedback failed to reduce water consumption. The implications of the results are discussed in terms of their implications for municipalities in their water planning efforts.

SECTION I

INTRODUCTION AND JUSTIFICATION OF RESEARCH

With the great heat wave and drought during the summer of 1980, attention was focused on the need to better understand factors influencing water consumption. Such a need is readily apparent in the agricultural area. In North Dakota alone the minimum estimated loss to the state's economy was $12 billion (Tulsa World, 1980). Less apparent to those not directly involved are the effects of drought on cities and towns. During the 1980 drought, 92 communities in Oklahoma were suffering severe water shortages, and in two cases towns were completely out of water for varying lengths of time.

The effects of water shortages on cities and towns are varied. Losses to landscape shrubbery, lawns, and other vegetation were clearly apparent. A water shortage may also affect the quality of the drinking water due to the inability to dilute wastes with the reduced water volume. The availability of water also influences water pollution control and sewage disposal needs. Indeed, the first comprehensive, large scale, continuous water conservation effort was motivated by water pollution control needs (Washington Suburban Sanitary Commission, 1974). Finally, water shortages also affect a city's economy, particularly water dependent businesses such as landscaping, car washing, and manufacturers dependent on a city water supply.

The authors believe that an important component of planning for the long term water needs of a municipality is reliable information on the ability of citizens to conserve water. Traditionally, several factors have been considered in planning for the long-term water needs of a municipality. The expected population size, demands by agriculture and industry, and the severity and likelihood of drought are particularly relevant. In planning for the size of the water impounding structures and treatment facilities, it is customary to think in terms of maintaining the water supply even with the occurrence of a 100-or 500-year drought. However, insurance of an adequate water supply under such extremes can lead to very costly structures which far exceed the normal needs of a community. Municipalities can build structures at significant cost savings only if they are armed with reliable data on how much water can be conserved over the water shortage period.

Problems exist, however, in anticipating how much water can be conserved because little is known about factors influencing the water consumption behavior of individuals. Most of the work on water conservation has been crisis-oriented and, therefore, not sufficiently systematic or long-range in approach (Englevat, 1979) to be of much help in water planning efforts.

An understanding of factors influencing water conservation behavior has benefits beyond those involving the avoidance of water shortages due to drought. Water shortages can exist even in the face of a water surplus. For example, high short-term demand on water treatment facilities can result in shortages even though reservoirs are brimming with water. Furthermore, the consumption of water is inextricably tied to the consumption of energy (Sharpe, 1978). In California 7 percent of the state's total electrical power was required in 1972 to supply water to the point of use (Roberts, 1978). In homes, heating water is the second largest consumer of energy.

In summary, from a variety of perspectives, an increased understanding of the factors influencing the water consumption of urban residents is important. The present research paper, therefore, is written as an initial effort in furthering such understanding. The paper first reviews available information on the reactions of municipalities to water shortage conditions. The types of community responses are briefly mentioned as well as the outcomes in terms of water consumption reductions. In the second section, the paper reviews literature which identifies factors shown to influence residential water use. Such factors as demographic trends, educational compaigns, and management tools are discussed. Noting that residential water consumption has not been investigated from a theoretical perspective (excluding economic pricing studies), the paper next reviews literature from the energy conservation field and from other environmentally relevant areas of study. The concept utilized is that problems associated with persuading people to change their behaviors in such areas as water use, energy use, and littering, share similar determinants, and the knowledge gained and theories applied in one area may be applicable to another. The major portion of the paper presents a field research study in which three factors were experimentally manipulated in order to test their effects on residential water usage.

SECTION II

A BRIEF REVIEW OF MUNICIPAL REACTIONS TO WATER SHORTAGES

Three major categories of water users are identifiable--residential, industrial, and agricultural. The methods of reducing water consumption may vary widely within the three categories. Particularly in the industrial and agricultural sectors, the potential methods for reducing consumption are based in large part on the nature and technological sophistication of the industry or farming enterprise. For these reasons and because industrial and agriculture water use patterns are beyond the scope of this study, only the residential sector will be examined. This review of residential water use patterns is not meant to be exhaustive. It is written as a point of comparison for the research study presented later in the paper.

Numerous communities in the United States have faced water shortages brought on by a combination of drought and growth. Based upon the accumulated experience, clear evidence exists that water consumption can be lowered in response to drought conditions--at least in the short term.

Some of the types of responses by communities to drought and water shortages are summarized in Table 1. The table identifies communities experiencing enforced conservation programs, the conservation methods undertaken, the reasons for the program, and the percentage reduction of water use. Table 2 presents a listing of the types of methods utilized to reduce consumption.

A key problem in assessing the effectiveness of various approaches to residential water conservation is that no systematic studies have been undertaken to determine the relative impact of the approaches. City councils typically act in relation to the severity of the drought. They first make appeals for citizens to reduce their water usage; they then promulgate regulations to limit outside use of water; next, they may impose maximum usage rates; and, finally, they adjust the pricing structure. Thus, it is difficult to draw firm conclusions regarding the relative efficacy of various water conservation techniques.

Some preliminary indications of the amount of water conserved can be estimated from the experience of the communities listed in Table 1 . In only one case was a totally voluntary approach utilized in which only persuasion and passive flow control measures were undertaken. This occurred in some suburbs of Washington, D.C., and resulted in a 4.4 percent reduction in water consumption. A number of cities and countries have combined "use restrictions" with persuasion and passive flow control approaches. They include Detroit, New York, Pawtucket, RI., and Great Britain. Here conservation ranged from 20 percent to 63 percent with an average of 30.4 percent. Simply by severely restricting outside use, water use reductions of about 20 percent appear feasible. Rationing and the implementation of excess use fines brings the expected figure to about 30 percent.

The long-term effects of conservation practices on residential water usage is less clear. However, with the installation of different types of plumbing, the encouragement of landscaping with less water intensive vegetation, the pricing of water to meet its true cost, and widespread acceptance of water saving devices, long term reductions in residential water usage appears feasible. Larkin (1977) estimates the East Bay Municipal Utility District's 38 percent reduction in water consumption during the 1977 drought in Northern California will stabilize to a more permanent 15 to 20 percent reduction.

TABLE 1

COMMUNITIES AND THEIR WATER CONSERVATION PROGRAMS

Community	Conservation Method Used	Percentage Reduction	Cause of Program (capacity at low point)
Detroit 1952-54	1, 9, 11	None--lowered peak usage.	Low water pressure from high peak demands
New York City 1949-50	1, 11, 13, 14, 15	20% to 25%	Drought
New York City 1963	1, 2, 3, 4, 5, 11, 13, 14, 15, 24	22.2%	Drought-(54% capacity)
Pautucket, R.I. 1967	1, 15	16-18%	Drought
Northern California 1976-77 East Bay Util. Dist	1, 3, 4, 10 (35%), 11, 12, 13, 14, 15, 19, 20, 21, 24, 26	37.9%	Drought 22% Capacity
Southern California Metropolitan Water District 1977	1, 6, 9, 19, 22 Los Angeles instituted 10% mandatory rationing	10% to 15% depending on city 20% decrease in Los Angeles	Drought: Water from Northern California cut off.
Washington, D.C. 1971-73 Suburban San. Com.	1, 4, 6, 7, 8, 9, 16, 25, 27	4.42%	Sewer Crisis. Had to Reduce Sewer Flows
Denver 1977	1, 4, 10 (20%), 11, 17, 18, 19	21.0%	Drought plus lack of treatment facilities (65% capacity)
Sao Paulo 1969 Brazil	1, 5, 20, 21, 24	26.3%	Drought--(47% of capacity)
Great Britain 1976 Nation Water Council	15	25%	Drought
Marin, County 1977	15, 18, 20	25% for outside use 63% rationing with fines	Drought

1. Numbers are Keyed to Table 2 "Conservation Methods."

TABLE 2

Conservation Methods

Persuasive Approaches

1. Publicity programs (Press Releases, TV Features)
2. Door-to-Door campaigns (Boy Scouts, volunteers)
3. Contact industry
4. Flyers, brochures, and handouts on water-saving appliances and methods
5. Sound trucks, banners on vehicles
6. Contests, bumper stickers, T-shirts, buttons
7. Workshops
8. Slide programs, movies
9. Radio, TV, Newspaper Ads (Paid)
10. Goal setting

Use Restrictions

11. Restrict or control lawn springling (time of day, day of week) (Air conditioning using water--Detroit, 1952)
12. Swimming pools
13. Car washing
14. Cleaning buildings, driveways
15. General nonessential use
16. Revise plumbing codes
17. Limits on new hookups
18. Fines for failure to comply
19. Excess use surcharges
20. Rationing
21. Water use cut-offs--short term
22. Credit programs to member agencies of water board
23. Increase water rates

Leak and Flow Control Approaches (Nonregulatory)

24. Leak inspection
25. Leak detection (kits and literature)
26. Provide flow control devices
27. Test programs or conservation devices

SECTION III

SOME FACTORS SHOWN TO INFLUENCE RESIDENTIAL WATER USE

Factors affecting residential water consumption can be losely grouped into categories according to the ease with which they can be modified to reduce water demands. Beginning with most difficult factors to change, these categories are user demographic characteristics, management tools, and educational campaigns. Demographic data relates to water usage based upon characteristics of the population such as age, income, and social status. Management tools refer to policies which may be introduced such as changes in pricing and the introduction of water saving devices. Educational campaigns, the most widely applied set of methods used to influence water usage during drought (Sharpe, 1978), include campaigns to encourage public awareness of drought, to change attitudes towards water as a scarce resource, to induce conservation habits, and to gain public involvement in water demand management. These three sets of factors will be discussed in turn.

Demographic Factors

Demographic factors affecting household water use can be used to aid in the prediction of future water needs and to help predict the kinds of voluntary conservation programs most likely to be effective. Such factors as changes in age patterns, movement from single to multiple family units, changes in household size, and changes in income have serious implications for municipal water storage and distribution planning. Demographic variables include age, income, size and life cycle stage of household, education levels, social class, manner of effluent disposal (septic or sewer) and consumers' preferences (backyard pools, gardens). Identification of those groups likely to be the most responsive to a voluntary conservation program is important in minimizing the cost of administering it. For instance, groups with the lowest levels of discretionary water use or overall consumption rates might be omitted from a conservation program.

Income. Income levels have been directly linked to water consumption in several studies (Potter, 1976; Lupsha, 1975; Linaweaver, 1967). Potter's results showed that at the highest income levels, 4,100 to 4,500 gallons per person per month were consumed, compared to one third that consumption at the lowest income levels. The middle class consumed twice as much as the lower income group. Similarly, in an earlier study (Linaweaver, 1967), households of higher income levels (determined by market value of the home) used the most water, except in homes with septic tanks. Homes with septic tanks use slightly less water than comparable homes with sewer systems (Grima, 1979). High incomes were also associated with high usage rates in Lupsha's study (1975).

Household size, social class, and life cycle have also been shown to be associated with changes in residential consumption. In New Hampshire, Andrews and Hammond (1970) found that regardless of family income, physical characteristics of the home, or community location, per capita consumption decreased as the number of persons increased, which indicates a threshold level of water use. This level is most likely established by the requirements of certain appliances and habits, i.e., dishwashers, washing machines, and lawn watering, which might not change significantly with the number of household members. Likewise in New Mexico (Lupsha, 1975) per capita consumption (estimated at 114-152 gpd) decreased as household size increased.

Exploration of the relationships between social class, family size, and life cycle stage by Spaulding (1968) showed that water use seems to be related to the family cycle stage, rather than social class position, although households of higher status tend to use more than households of lower status. Size of household and water use were positively related, but the relationship was not statistically significant.

The New Hampshire study also revealed that adults used the most water, and older children had a greater influence than younger ones (Andrews and Hammond, 1970). To our knowledge this is the only study which specifically related age to water usage.

Management Tools

Methods which have been characterized as water management tools include use of pricing, which necessitates the need for metering, and the introduction of water saving devices, which may or may not include plumbing code revisions for new construction. Our review indicates that these tools can be relied upon in most cases to achieve significant and immediate results in altering water usage.

Pricing. Pricing as a means to achieve water reduction cannot be considered separate from metering since effective pricing cannot be implemented without metered use of water. Hanke (1970) reports that introduction of meters results in appreciable decreases in consumption, while according to Graham (1976) price induced water user reductions may only be temporary. However, Graham notes that the cost of water is still a small portion of a family's income. In a study of three New Hampshire communities, (Andrews and Hammond, 1970), the low cost of water (about .4 percent of annual income) is linked to a lack of interest in conservation. According to Sharpe (1978), prices must rise to a level comparable in homeowner budget importance to that of energy for pricing to affect use.

Grima (1979) found in a study of 43 Ontario municipalities that in many cases absurdly low prices (sometimes not even covering average costs) were charged heavy users. The use of such declining block structures has been the lure used by communities to attract heavy water consuming industries. (Declining block structures are water pricing schemes that charge less for increasing amounts of water consumed.) Grima's study found that noncost factors contributed to more than 70 percent of the variance found in water prices (water prices ranged from 13 to 70.2 cents per 1,000 gallons).

Several authors have noted that reliance on metering and pricing as a means to achieve water use reductions has limitations and drawbacks, some of which are considerable. These problems include public resistance, utility revenue losses, difficulty in converting to marginal pricing, the high cost of installing and maintaining a pricing program, and varying price elasticities. For example, public resistance to significant price hikes was noted by Sharpe (1978). Public refusal to decrease water usage has been found when a sliding scale was developed which increased rates if water usage rose above a certain level (Washington Suburban Sanitary Commission, 1968). Additionally, it has been suggested that low and fixed income groups may not embrace water pricing policies, since they will disproportionately bear the higher water prices (Sharpe, 1978).

Not only do consumer reactions to significant price changes pose problems, but utilities may also incur substantial revenue losses if consumption drops dramatically. In the 1977 East Bay Municipal Utility District drought experience in California, voluntary conservation at the rate of 38 percent necessitated a rate increase of 33 percent, plus $6.8 million in grant and loan funds to offset the economic losses and cover the utility's fixed costs (Larkin, 1978).

To minimize the adverse impact of water conservation on utility revenues, Sharpe (1978) recommended the use of marginal cost pricing to make the consumer pay the true cost of water and to provide revenue stability. A typical marginal pricing is as follows: prices that apply to a unit of water are equal to the marginal cost of producing that unit, and these incremental prices are generally added to a certain fixed monthly charge to the customer that reflects coverage of the utility's fixed costs. Using this scheme, a utility should be indifferent to losses due to conservation, since marginal costs and revenues should drop together and fixed debt coverage would be unaffected (Boland, 1975).

In addition to holding promise for utilities, marginal pricing may stimulate conservation among consumers. That is, consumers would be able to link reductions in use of water directly to a lowered water bill, instead of paying a monthly fixed charge for use, which does not

promote conservation (Grima, 1979). Since consumers would pay for a service in proportion to its true cost, they would be less likely to oppose conservation on the grounds that it stimulutes rate increases as it did in the case of the East Bay Municipal Utility District (Larkin, 1978).

The difficulty in converting to marginal pricing and the high cost of installing and maintaining a pricing program has been noted by several researchers (Flack, 1973; Sharpe, 1978; Temporary Commission on Water Supply Needs of Southeastern New York, 1973; Grima, 1979). Several major cities such as Denver, New York, and Toronto, as well as many other large cities, do not meter water to residential water users. If metering is implemented by a city, the savings accrued from reducing investment outlays must exceed the cost of installing, reading, and maintaining meters. Prices should reflect the marginal costs of implementation, according to generally accepted economic principles for maximum efficiency (Grima, 1979).

No research has been found on the extent of marginal pricing in the United States or the estimated costs of utilities' conversion, costs to the consumers, or nationwide impact on conservation efforts. This seems to be an area that needs immediate attention.

For pricing policies to be effective, the consumption of water by consumers must respond to changes in the price of water. Economists call such responsiveness the elasticity of demand. Some evidence exists that water consumption, especially indoor use, is price inelastic and will not respond readily to price changes (Grima, 1979; Sharpe, 1978). Estimates of price elasticity of indoor water use ranges from -.22 to -.30 to -.45 (Grima, 1979; Turnovsky, 1969; Renshaw, 1958) while elasticities for outdoor water use are perhaps double, if there is a separate charge for outdoor use. Two other studies (Burns et al., 1976; Schaeffer, 1976) found that lawn watering is more sensitive to price increases than is indoor use, supporting the concept that outdoor water use is more price elastic than indoor water use.

Water Saving Devices. According to recent studies, water conservation devices such as shower flow controls and toilet inserts are highly effective in achieving permanent water use reductions, and are cost effective and acceptable to consumers (Erb and Fabian, 1977; Sharpe and Fletcher, 1977; Schaeffer, 1976; Cohen and Wallman, 1974). In the early 1970s, estimates of potential indoor water savings possible with available devices ranged from 32 to 45 percent of normal indoor needs (Howe, 1972; University of Minnesota, 1974). For instance, toilets use about 45 percent of the indoor water consumed (Washington Suburban Sanitary Commission, 1978) and toilet inserts can reduce the customary five to seven gallons a flush to about 3.5 gallons. Projections for the state

of California (Koyosako, 1977) show that if all the homes in the state were given water saving devices, and only two percent used them, the program would pay for itself in energy savings alone in ten years.

Widespread application of water saving devices in household use is not without constraints. Sharpe (1978) noted three problems. First, there is not a great amount of verifiable data on the effectiveness of various devices. Second, there is a lack of unbiased data on the performances of devices currently on the market. Third, water conservation devices (apart from toilet inserts which can be made from any plastic container) are not readily available in hardware stores or plumbing supply outlets.

Education

Severe droughts have been publicized in the United States since the dust bowl days of the 1930s. Yet public awareness of water as a scarce resource has made little advancement until the extreme droughts of the late 1970s which occurred in California and other parts of the nation. Research literature notes that as early as 1950, excessive demands on a municipal system necessitated the restricted use of water. Throughout the 1960s and early 1970s, various authors have noted a lack of knowledge about water usage in household activities (Flannery, 1968), about water suppliers and sources (Watkins, 1972; Abbot, 1975), and about treatment and prices (Office of Water Research, 1972). McPherson (1978) concluded that anti-conservation attitudes of water professionals can be impediments to successful conservation programs. He noted that these professionals have acted as if the public should have all the water it can pay for, which could be substantial given the historically low price of water.

An early 1970s survey in West Palm Beach, Florida, found that a majority of people had never thought about cutting water consumption and most never expected a shortage (Watkins, 1972). A report for the Office of Water Resources Research showed that in 17 Eastern U.S. communities that had imposed water use restrictions, most people wanted to save water but don't know how. The report recommended that educational campaigns by utilities could correct this problem (Abbott, 1972).

An approach directly related to education involves gaining public involvement in decision making. In 1976, Heberlein noted that the public is becoming increasingly concerned with decisions involving natural resources. In contrast, earlier work (Borton and Warner, 1971) noted the difficulty of obtaining public participation in water resource planning. Heberlein stated that the public's growing interest results from three factors: (a) the potentially conflicting uses of natural resources, (b) the rapid changes currently occurring in values regarding the environment, and (c) a growing mistrust of government.

Glasser, Monty, and Hehman (1975) provided a comprehensive overview of public participation and public education techniques. The authors listed 22 different ways in which the public can participate in decision making. The methods varied from public hearings to formal attitude surveys to law suits. One of the implications of the article was that active public involvement reduced the likelihood of filing law suits.

Heberlein (1976) analyzed a number of techniques for gaining public involvement in water resource planning: public hearings, public opinion polls, and workshops. First, the public hearing allows planners to provide information to the public, to gain citizen involvement, to interact with the public, to meet prescribed regulations, and to diffuse potential disasters. The major problem with public hearings is the potentially unrepresentative nature of the information obtained.

A second approach is the public opinion poll. Its major strength is that decision makers can obtain an accurate view of the population's stance on an issue. Problems involve the costs, time to accomplish the survey, and the difficulty of capturing complex issues in relatively simple questions.

A third approach to public participation involves sponsoring workshops. In these the public, the planners, and the politicians are brought together in an equal fashion to reach consensus on key planning issues. Problems here involve obtaining adequate representativeness and maintaining interest over the life of the workshop.

Indeed, a 1976 study by Beatty found that citizen advisory committees, compared to other groups of participants in water resource politics, are least representative of the general public in background characteristics. Advisory committee members tend to be better educated, have higher incomes, are waterfront property owners, and heavy water users. The participation group most respresentative of the general public are those who sign petitions. Beatty also found that participants in water resource policy, regardless of the nature of the participation, tend to be more dissatisfied with water resource policy than does the general public.

Riordin (1976) describes an actual case in which a water district in Canada attempted to gain public participation in the planning process. The planning process consisted of three phases. First, public meetings and seminars were held. In addition, questionnaires were sent out and public interest groups contacted. The objective of the first phase was to understand the goals of the region's residents over the next 50 years. In the second phase, the planners formed what they called "public interest task forces." Composed of four groups (organized public, unorganized public, special interest groups, and local politicians) the purpose of the task forces was to reach consensus on a

preferred course of action for particular problem areas. The third and final phase consisted of a public education program in which local media were utilized to provide information on progress of the project. In all, $200,000 was spent on the three components of the program. Riordin reported that overall the project was successful in its attempt to meaningfully involve the public in the planning process.

For a number of reasons, the implementation of a program in which additional water supply capacity is replaced by a systematic conservation program must be preceeded by thorough public involvement. According to Ertel and Koch (1977), public participation (1) fosters a sense of community; (2) enhances self-development of individual citizens; (3) leads to improved policy; (4) facilitates policy implementation; and (5) fosters democracy.

After a program's cost effectiveness is established, planners can enhance the program's political and social feasibility through public involvement in the implementation of it. As noted by Borton and Warner (1972), planners must carefully consider the values and preferences of residents in affected regional areas. Finally, such questions as what kinds of resources, financial liabilities, investments, and quality of life are we bequeathing to future generations should be addressed in an open, public format. What might be feasible in one area may not be in another. For example, the issue of growth versus no growth can take on heavy importance. The reaction of residents in Marin County, California, or Boulder, Colorado, might be quite different from areas interested in growth such as Phoenix, Arizona, or Broken Arrow, Oklahoma. Consideration of public and political opinion along with active participation of citizens, politicians, and planners can result in the avoidance of misguided projects as well as lawsuits (Heverlein, 1976).

SECTION IV:

RESEARCH ON ENVIRONMENTALLY RELEVANT BEHAVIOR

The above literature review reveals that no controlled experimental studies investigating residential water use have been performed. The previous work has consisted mainly of correlational studies seeking to identify relationships between consumption and other variables, such as income level and other demographic variables. The studies on the effects of educational campaigns have been correlational in nature and rely extensively on questionnaires. The studies in the pricing area have used existing data which tends to lead to an analysis confounded by extraneous, uncontrolled variables. In contrast, research in other environmentally relevant areas, such as energy and bus ridership, have tended to use experimental research designs, which control for extraneous variables. Additionally, research in these areas has focused more on developing theoretical relationships between behavior and relevant

controlling variables. The authors believe that such research has applicability to the water consumption area and consequently it is reviewed briefly in this section.

Behavioral research directed at altering man-environment relationships has included such topics as litter deterrence (Burgess, Clark, and Hendee 1971; Chapman and Risley 1974; Kohlenbert and Phillips 1973; Powers, Osborne, and Anderson 1973), increasing the purchase of returnable bottles (Geller, Farris, and Post 1973), and increasing bus ridership (Everett, Hayward, and Meyers 1974). Considerable literature also exists regarding energy conservation (for instance, Seaver and Patterson 1976; Becker 1978; Hayes and Cone 1977).

Behavioral studies of environmentally relevant behaviors generally fall into a few groups of treatment conditions including: feedback of outcomes, positive and negative rewards (both financial and social), goal setting, and information dissemination or prompts. Studies on the effects of feedback on energy consumption have received recent attention and seems an especially viable treatment in both energy and water use due to the monthly billing procedures of utilities.

Although feedback has been consistently related to the learning of control tasks (Amons 1956; Bilodeau and Bilodeau 1961) and to task performance (Locke, Cartledge, and Koeppel 1968), the results from energy conservation studies are more equivocal. Seaver and Patterson (1976) found no significant main effects for feedback on fuel oil consumption rates. Becker (1978) also found no main effects for feedback on rates of electrical consumption by homeowners. In both cases, however, feedback interacted with other variables (e.g., social commendation and goal difficulty) to affect energy conservation.

Two other studies have shown that feedback can affect electrical energy usage. Seligman and Darley (1976) found a feedback effect when consumption rate information was provided four times weekly. Haynes and Cone (1977) also found a main effect for feedback but concluded that financial rewards produced a much stronger effect.

The results of financial and social reward treatments show much greater consistency. Although a case can be made that energy conservation always produces financial inducements in a market economy, several studies have examined rewards in more controlled settings. Direct payment for reduced consumption rates affected conservation behaviors in studies by Hayes and Cone (1977), Winett (1975), and Kohlenbert (1976). The efficacy of financial incentives has also been demonstrated in litter deterrment (Burgess, Clark, and Hendee 1971; Chapman and Risley 1974; Kohlenberg and Phillips 1973; Powers, Osborne, and Anderson 1973) and in increasing bus ridership (Everett, Hayward, and Meyers 1974). Seaver and Patterson (1976) and Geller, Farris, and Post (1973) have

similarly found social rewards to effectively induce environmentally relevant behaviors.

Since conservation campaigns often begin as governmental programs and involve distinct goals as well as educational information, goal setting and information or prompts variables would also seem particularly appropriate for investigation. However, only one researcher has systematically examined the effect of goal setting on energy conservation. Becker (1978) found that assigning goals which were difficult to reach reduced electrical consumption, but only when combined with frequent feedback. He reasoned that without a goal, feedback is irrelevant, and without feedback one cannot assess the impact of efforts expended in the conservation attempt.

Much more research has been conducted on the effects of information or prompts. Hayes and Cone (1977) found that educational information on methods of energy conservation and energy costs of appliances did not affect electrical usage. Heberlein (1974) also found that an informational campaign of the federal government had no effect on electrical consumption in an apartment complex. However, Craig and McCann (1978) found that information from a high credibility source (Public Service Commission) was more effective than information from a lower credibility source (Con Edison) and did result in a decline in electrical consumption. Geller, Farris, and Post (1973) also found that prompts alone or combined with public charting procedures were effective in increasing the proportion of soft drinks purchased in returnable as compared to nonreturnable bottles. Walker (1980) reviewed a number of studies assessing the effect of the Arab oil embargo on energy usage. Walker concluded that the preponderance of the evidence supported the hypothesis that a voluntary reduction in energy usage followed the embargo independent of changes in the cost of energy. He also warned, however, that the extent of the response depended upon many factors.

SECTION V

THE STUDY

The purposes of the current study were three-fold. First, the researchers hoped to extend the findings from energy conservation and related environmental research into the water conservation area. Such extension seems a logical first step in understanding the factors influencing residential water use. Based on the literature review, the researchers decided to test the efficacy of feedback and prompts (reminder notices) in a water conservation setting. Given Becker's (1978) conclusion regarding the interdependence of goals and feedback, the feedback condition was performed in a municipal setting having a water use reduction goal of 10 percent. That goal had been set by the City Council of Stillwater, Oklahoma, and had been widely disseminated

to city residents. This study, then, would extend previous research into the water conservation area and test a new combination of conservation variables.

The second purpose of the study was to test the effects of a variable suggested by the notion that residential water consumption is not the result of a single consuming individual. Rather, it is the result of consuming families. Conservation of water should, then, involve family, rather than individual behaviors. Further, since conservation may involve substantial inconvenience, individuals who lack serious commitment may not persist in conservation efforts. These considerations suggested that gaining family commitment to conservation efforts would enhance such efforts.

The third purpose of the study involved the goal of relating conservation attitudes to water consumption behavior. Thus, questionnaires were administered before and after the experiment. Responses to the questionnaires could then be related to the water consumption of the participants in the study.

Methodology

Overview. The study was conducted in three distinct stages: a pre-experimental stage, an experimental stage, and a post-experimental stage. In the pre-experimental stage, a water conservation questionnaire was administered to 180 of the 200 families who participated in the study. The purposes of this questionnaire were to assess levels of conservation awareness, and the attitudes and behaviors that existed prior to exposure to the independent variables.

The second stage consisted of implementing the experimental conditions and the weekly collection of data regarding participants' water consumption. Water consumption data were gathered from all 200 families.

The post-experimental stage consisted of the collection of monthly rate of water consumption by the 200 families following the discontinuation of the experimental conditions. These follow-up readings were made for three months. Participants were later contacted by telephone and a second water conservation questionnaire was administered. The purposes of this questionnaire were to check the experimental inductions, to isolate factors that may have affected the study (such as unexpected vacations during the second stage), and to assess changes in participant awareness, attitudes, and behaviors.

The pre-experimental and experimental stages were completed during the months of June, July, and August 1979. The procedure required research assistants to administer the initial questionnaire and place respondents in the experimental conditions during a single, but lengthy,

home interview with each participant. Since each interview was lengthy, it was necessary to conduct them over an extended period of time (28 days) before all 180 families had been interviewed. A fully randomized participant interview schedule was used to accomodate this necessity. Therefore, the pre-experimental and experimental starting dates varied from family to family such that the time factor would not differentially affect the experimental and control conditions. The experimental stage for each participant began when the interview session and questionnaire were completed.

Choice of Independent Variables. The selection of independent variables for the study was guided by three research goals. First, our review of research on energy conservation and other environmentally relevant research revealed that the presence of feedback regarding rates of energy consumption has been found to influence energy conservation behavior. If feedback is generally effective in encouraging environmentally relevant behaviors, it should act to induce water conservation behaviors. Therefore, it was selected for manipulation in the present research.

Second, the researchers wished to test experimental variables that could be easily and inexpensively implemented by municipal or other water regulation agencies. Given the suspected nature of these agencies and their billing procedures, it was felt that some type of water conservation awareness or educational literature could be easily administered. Previous literature indicated that educational and awareness programs may be a necessary component of the development of environmentally relevant attitudes and behaviors. An inexpensive but potentially useful approach would, then, be the inclusion of simple "reminder" messages with the billing statements. These reminders would contain information regarding water supplies, the rationale for conserving water, and so on. Such reminders could be printed and distributed quickly and inexpensively within existing billing procedures of municipal water boards and utilities.

Third, selection of experimental variables should be theoretically interesting and contribute to further understanding of factors that underly water conservation attitudes and behaviors. For example, a second benefit of varying the presence or absence of a reminder orthogonally with the presence or absence of feedback, is that a potential confounding of these variables may have occurred in previous experiments. When an individual is given feedback, he or she is also reminded of whatever goal was originally set, e.g., reduce electrical usage by 20 percent. It may be that the reminder component of the feedback, rather than the feedback itself, produces the effect. If it were found that a reminder alone produced the same effect as feedback, important public policy implications would result.

The third independent variable (pledge-type) was chosen because of its potential theoretical relevance to the conservation literature. Pledge type refers to whether a pledge to reduce water consumption by 10 percent was signed by only one adult household member, or rather by the entire family. It was reasoned that water conservation is a family rather than individual task, and that the goal/feedback effect would be more effective in a family pledge condition. Hence, the third independent variable manipulation was intended to test the theoretical rationale that families would conserve more water when all members pledged their effort, rather than with the pledge was made only by one adult member.

Dependent Variables. The primary dependent variables of interest were: gallons of water consumed by the family, and the respondents' attitudes, and attitude change toward water conservation.

Research Design

The effects of feedback, reminder, and pledge type on rate of residential water consumption were explored in a 2 x 2 x 2 full factorial design. The experimental conditions were:

1. weekly feedback on rate of water consumption vs. no feedback.

2. weekly reminder of public need for water conservation vs. no reminder.

3. family decision and signing of conservation pledge vs. adult individual decision and signing of the pledge.

Two control groups were also created: a questionnaire control group and a no-questionnaire control group. The inclusion of these control groups would allow comparisons to control for possible threats to internal validity of the design (such as history and testing-history interaction). The experimental design is schematically presented in Figure 1.

Three main hypotheses were specified:

H_1: Given a specific conservation goal, residences receiving weekly feedback on their rate of water consumption will consume less water than residences not receiving weekly feedback.

H_2: Given a specific conservation goal, residences receiving weekly prompts (reminder notices) will consume less water than residences not receiving prompts.

H_3: Given a specific conservation goal, residences in which all family members participate in the conservation decision and sign a conservation pledge will consume less water than residences in which the decision is made by only one adult member who signs the pledge.

Interaction hypotheses were of potentially greater interest than the above main effect predictions. However, it was felt that the lack of a general theory of conservation behavior precluded their development. Given that conservation behavior is a unique form of consumer behavior which involves inconvenience (as opposed to convenience), unpredictable interactions might occur. For example, prompts might serve as constant reminders of the perceived inconvenience of conserving water. In combination with feedback, consumers might react against the messages and restore their perceived behavioral freedom by consuming more water (Brehm, 1966). Alternatively, such prompts, when combined with feedback, might have an additive effect to decrease consumption maximally. Despite the inability to make interactive hypotheses, such interactions would add important dimensions to the conservation literature and perhaps enhance the ability to propose a general conservation theory.

Sample

Stillwater, Oklahoma, was a particularly appropriate research site, due to an extended water shortage in 1979. Prior to the onset of the study, the City Council had made a broad public appeal for residents to reduce water consumption by 10 percent. Further, the city personnel were interested in this research project as potentially useful to their need and cooperated in the data collection.

Three hundred and fifty (350) single family dwellings were randomly selected from the city utilities water records. The records were evaluated and only those meeting the following criteria were included as potential participants in the study:

1. Same family at residence for past 12 months.

2. Last year consumption during experimental time period of more than 100 gallons or less than 10,000 gallons per month.

The remaining residences (280) were randomly assigned to treatment and control conditions such that 20 residencies appeared in each of the ten cells of the experiment. Six graduate assistants were then randomly assigned to homes in geographically sectioned areas of the city. Six additional families were discarded when they refused to participate in the study for personal reasons (vacation schedules, etc.), and fourteen

EXPERIMENTAL CONDITIONS						TIME PERIODS		
Pledge Type		Feedback		Reminder		Experimental Periods		Follow-up Period
						E_1	E_2	
Family		yes		yes	n=20	dv[1]	dv	dv
Family		yes	n=40	no	n=20	dv	dv	dv
Family		no		yes	n=20	dv	dv	dv
Family	n=80	no	n=40	no	n=20	dv	dv	dv
Individual		yes		yes	n=20	dv	dv	dv
Individual		yes	n=40	no	n=20	dv	dv	dv
Individual		no		yes	n=20	dv	dv	dv
Individual	n=80	no	n=40	no	n=20	dv	dv	dv

CONTROL CONDITIONS				
1. questionnaire only	n=20	dv	dv	dv
2. no questionnare	n=20	dv	dv	dv

Figure 1. Experimental Conditions and Time Periods

[1](dv = dependent variable)

residences were vacant. These residencies were replaced by new homes on a randomized basis from the remaining 80 unassigned homes. The final sample size was 200.

Procedure

Initital interviews were conducted with either the male or female adult who answered the door of the house. The research assistants explained who they were and that the household had been randomly selected to participate in a study on water conservation. They further explained that as an intitial step in the study they would like the individual to complete a questionnaire for the purpose of identifying existing water use behaviors. (The questionnaire is shown in Appendix I).

After completing the questionnaire, instructions were given to the individual in order to place the family into the randomly assigned experimental condition. In the questionnaire control condition, the research assistant merely thanked the individual and left. Residents in the no questionnaire control condition were not interviewed; however, weekly water consumption readings were conducted.

Feedback. Individuals receiving feedback on their water consumption rate were told:

> One of the things we will be doing is giving you feedback on your water consumption. Everyone in Stillwater has been asked to reduce their water consumption by 10 percent. So your goal will be to reduce your monthly consumption by 10 percent. This space on the card will show you if your are reaching your goal. Do you have any questions?

The research assistants carefully explained to each participant the feedback form which would be given each week. The form gave them their water consumption for the current week, their consumption for the week before, an estimate of their total consumption for the month, their consumption for the month during the last year, and the percent change between the month this year and the same month last year. The last figure was pointed out as the way to identify if they were reaching the consumption goals.

Reminder. Participants in the reminder condition were told:

> You will also receive a weekly reminder to conserve water from us. It will be placed in your door or wherever you would like it. The purpose of the reminder is simply to keep up your awareness of the need to conserve water.

Four separate reminder forms were developed. Each form was used twice during the eight weeks of the experiment. Each version of the reminder indicated that the water meter had been read, gave some fact about the drought conditions in Stillwater, contained a reminder of the 10 percent goal, and encouraged the family to contact the water conservation team if questions occurred.

Pledge Type. In the individual pledge condition individuals were told:

> Finally, we would like you to sign an agreement to participate in the project. It is totally voluntary and no penalties will be levied in any way if your consumption goals are not reached. Let us add that everyone in Stillwater has been asked to reduce their consumption by 10 percent.

In the family pledge condition, the phrase "your family" was appropriately inserted into the first sentence. The pledge sheet was then left with the individual for family discussion and decision. The pledge, signed by all family members, was retrieved by the graduate assistant the following day.

Target consumption rates were indicated on all pledge sheets. These rates were based on the resident's water consumption during June and July the previous year and included the 10 percent reduction goal. The basic pledge agreement was identical in both individual and family conditions, except as noted above, and read:

> We pledge to try to reduce the water consumption of our family by 10 percent. The reduction will be in comparison to the adjusted monthly usage rates during the 1978 summer season. We have in our possession a booklet which provides a number of methods of reducing water consumption, and we will try out some of its ideas.
>
> We understand that no penalties of any type will occur if our family fails to reach its goal, and that participation is voluntary.
> Our family's target consumption rate is _____ gallons in June, _____ gallons in July, and _____ gallons in August.
>
> (All families in all experimental conditions received the booklet on water conservation.)

Following the completion of the experimental induction, the research assistant recorded the water meter reading. Subsequently the assistant returned every seven days to read the meter, complete feedback forms (as appropriate), and distribute the reminder (as appropriate).

Following the completion of the eight weeks of experimental conditions, three additional months of follow-up readings were taken. During these three months, all communications with the study participants ceased. Due to the staggered start (necessitated by the lengthy interview process) the final reading also varied across subjects, but again this did not differentially affect the experimental groups. The final follow-up reading was completed in November 1979.

Follow-Up Questionnaire

All available participants, including those in both control groups, were contacted by telephone in March 1980. The purpose of this questionnaire was to reassess water conservation awareness, attitudes, and behaviors. The follow-up questionnaire was modified to include a check on factors that could have affected the results of the experimental conditions. The researchers were especially concerned about unexpected or lengthy vacations and swimming pool use that would have affected water consumption rates. The follow-up questionnaire is shown in Appendix II.

Results

The results of the study will be presented in three parts: demographic statistics describing the sample, analysis of water consumption data, and analysis of awareness and attitudinal data.

Demographic Description of Sample. Demographic data were gathered by the pre-experimental questionnaire. These data are presented in Table 3. The data reveal that the sample was composed of relatively stable community members. The mean age calculated from the grouped frequency distribution was 44.1 years. More than half (58.8 percent) had lived in the area ten or more years, and three-quarters (85.4 percent) had lived there for more than three years. The average family size was 2.9 members. Typically, the family size was 2 (44.6 percent), 3 (24.3 percent), or 4 (19.2 percent). Eighty-nine percent of the households had one (41.8 percent) or 2 (46.9 percent) bathrooms, and two-thirds (67.8 percent) had an electric dishwasher.

The sample tended to perceive themselves as aware of the need for water conservation and engaged in some conservation behaviors prior to the interview. They reported themselves as lowering shower volume (62.3 percent), checking plumbing (94.3 percent) and toilets (96.0 percent), and washing only full loads of dishes (97.7 percent) and laundry (93.5 percent). They also tended to be conscious of outdoor water habits, reporting less use of water in washing cars (76.1 percent), cleaning driveways (79.2 percent), and some level of garden conservation (drip irrigation and hills around shrubs). However, few had installed water flow control devices (18.0 percent), placed quart bottles in toilets (17.3 percent), or flushed toilet with gray water (7.9 percent), or

TABLE 3

Descriptive Statistics for Participants

Demographic	
age	mean = 44.1
length of time in Payne County	% less than 2 years = 14.6% % 3-9 years = 26.6% % 10 or more years = 58.8%
number of members in residence	mean = 2.9
have one bathroom	% = 42
have two bathrooms	% = 47
have 3+ bathrooms	% = 11
have electric dishwasher	% = 68
Action Now Taking to Conserve Water	
lowering shower volume	% = 62.3
checking dripping faucets	% = 94.3
not using toilet as trash basket	% = 95.5
washing only full loads of clothes	% = 93.5
washing only full loads of dishes	% = 97.7
installing flow control devices	% = 18.0
insulating hot water pipes	% = 34.7
placing quart bottles in toilet	% = 17.3
putting gray water in toilet	% = 7.9

N = 180 (No Questionnaire Control group is excluded)

turned off water while soaping hair (40.4 percent). In general, residents tended to be engaged in water conservation behaviors that required minimal effort, but not in those requiring higher levels of effort or inconvenience.

Although city water officials had widely discussed the severity of the water shortage and had requested a 10 percent reduction in water consumption, nearly 80 percent of the participants believed the shortage was only moderate or less severe. Half (52.5 percent) believed the severity of the shortage would not increase even if the city and residents took no action regarding the problem. This corresponded to their belief that inadequate rainfall had led to the problem and that rainfall in the summers of 1979 and 1980 would solve the problem (49.4 percent) or at least somewhat help it (36.9 percent). Despite their belief that the shortage was caused by nature, most believed that water conservation would definitely help (38.4 percent) or at least help somewhat (37.3 percent). Related to this belief, 77.1 percent stated that they would do most or some of the conservation steps outlined in the water conservation booklet which was distributed (to the experimental treatment groups only).

Analysis of Water Consumption Data. Four basic approaches were followed in analyzing water consumption data. First a between-factors analysis of variance approach was used to test for effects among the experimental conditions. Based upon this test, the a priori hypotheses were examined. Second, a one-way analyses of variance was performed on the experimental and control groups. This test enabled the researchers to compare the experimental to the control groups. In the third approach, attitudinal and awareness variables were inserted as blocking variables to test for their ability to account for additional variance in the responses of the subjects. Finally, the between-factor analysis of variance results were examined in a post hoc fashion to identify any effects not hypothesized by the experimenters.

Analysis of variance (experimental conditions)--Water consumption data were first analyzed using a 2 (feedback) by 2 (reminder) by 2 (pledge type) by 2 (period) analysis of variance with repeated measures taken on the period variable. The two levels of the period variable were water consumption during the first four weeks of the experimental period (Period = E_1) and second four weeks (Period = E_2). The repeated measures analysis was performed on only two periods (eight periods were potentially available, i.e., weeks 1-8) to permit the inclusion of participants' consumption in 1978 (July and August) as a covariate. In this manner the periods measured by the covariate corresponded to the periods in the repeated measure. The general linear model program in SAS-79 was used to accommodate unequal cell sizes which resulted from experimenter decisions to exclude 12 families from the experimental portion of the study. These exclusions were due to broken water meters,

(which were found to be broken during the experimental period), unexpectedly lengthy vacations, or the presence of home swimming pools which were reported on the follow-up questionnaire. Consequently, cell sizes ranged from 16 to 20.

Table 4 presents the ANOVA table of the results. As seen in the table, the only significant main effect was for the period variable. More water was used by subjects during the second half of the study than in the first half of the study. Such an outcome was expected because rainfall fell from 4.32 inches in June to 4.11 inches in July, to 3.24 inches in August. When combined with the higher temperatures found in July and August, water consumption would be expected to increase.

One significant interaction was found among the experimental variables. A significant feedback by reminder interaction ($F = 8.54$, $p < .01$) was found. As shown in Figure 1, when a weekly reminder was received, participants used more water if they received feedback ($\bar{X}$ = 18,430 gallons) than if they did not receive feedback ($\bar{X}$ = 14,626 gallons). Conversely, if participants received no reminder, they used less water when they received feedback ($\bar{X}$ = 15,178 gallons) than when they did not receive feedback ($\bar{X}$ = 17,740 gallons).

Hypothesis three specified that participants in family conditions would consume less water than participants in individual pledge conditions. The appropriate a priori test for Hypothesis 3 involves a comparison of the condition in which a family pledge occurred, but no feedback or reminders were given, to the conditions in which an individual pledge occurred, but no feedback or reminders were given. As revealed in Table 4 consumption in the Family pledge condition was substantially higher (M = 19,032 gallons) than in the individual pledge condition (M = 16,448 gallons). However, this difference does not approach significance ($t < 1.1$). Based upon this analysis and the lack of main effects, no evidence of pledge-type effects were found in the data. Thus, the remaining a priori tests were conducted with data collapsed across the pledge-type treatment.

Hypotheses one and two specified respectively that participants in feedback conditions would use less water than participants in no feedback conditions and that participants in reminder conditions would use less water than participants in no reminder conditions. A priori tests (Winer 1971) were constructed to test for such effects. The appropriate a priori test for hypothesis one contrasts the no feedback-no reminder condition with the feedback-no reminder condition. (In each condition subjects signed a pledge and received no reminder.) The test revealed a significant effect, $t(142) = 1.68$, $p < .05$ one tailed, such that participants in the feedback-no reminder condition consumed less water (M = 15,178 gallons) than participants in the no feedback-no reminder condition (M = 17,740 gallons).

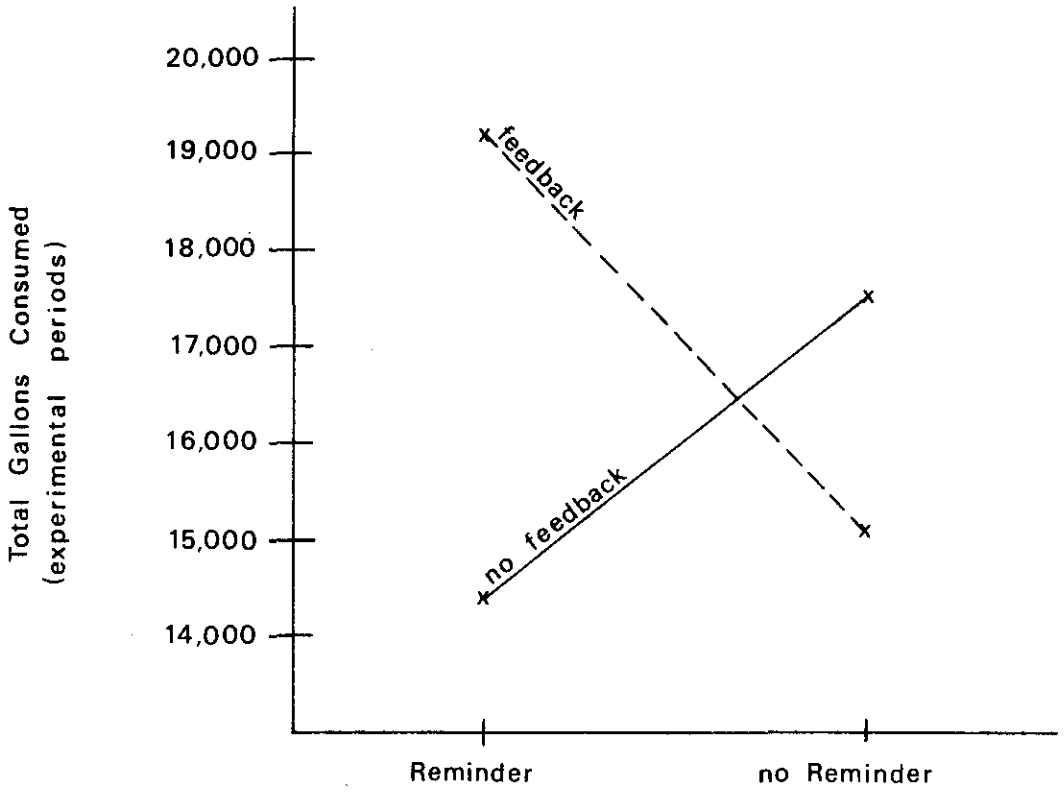
TABLE 4

2x2x2x2 Repeated Measures ANOVA
(1978 consumption as covariate)

Source	SS	df	F
Feedback (A)	7,586	1	.86
Reminder (B)	24,389	1	.76
Pledge type (C)	326,905	1	.26
Period (D)	626,085	1	8.34**
A x B	1,957,134	1	7.77**
A x C	618,455	1	2.46
B x C	871,595	1	3.46
A x D	181,831	1	2.42
B x D	902	1	.01
C x D	74,133	1	.99
A x B x C	751,814	1	2.98
A x B x D	17,899	1	.24
A x C x D	55,092	1	.73
B x C x D	267,866	1	3.57
A x B x C x D	3,236	1	.04
Covariate	829,203	1	11.04**
Subjects within groups	35,996,989	143	
D by subjects within groups	10,663,541	142	

*p < .05
**p < .01

Repeated measures existed on the D variable.



F I G U R E 2

Feedback by Reminder Interaction
During Experimental Periods

The appropriate a priori test for hypothesis two contrasts the no feedback-no reminder condition with the no feedback-reminder condition. (In each case subjects signed a pledge and received no feedback.) The test revealed a significant effect $t(142) = 2.04$, $p < .03$, one tailed, such that participants in the no feedback-reminder condition used significantly less water (M = 14,626 gallons) than participants in the no feedback-no reminder condition (M = 17,740 gallons).

A priori control group comparison--The two control groups were (1) a questionnaire only group and (2) a no questionnaire group. Water consumption data were gathered from these groups to permit a comparison of the control groups to the experimental groups. A 2 x 10 analysis of variance with repeated measures (period E_1 and E_2) was performed on consumption data to investigate these effects. (The one-way analysis was performed in order to obtain an appropriate error term so that a priori comparisons could be performed.) The one-way ANOVA revealed a significant treatment effect, $F(9,175) = 2.04$, $p < .05$.

Questionnaire Effect. The effect of completing a water conservation questionnaire on rate of water consumption was investigated by comparing the consumption rate of the questionnaire only control group to that of the no questionnaire group. The mean consumption rate of the questionnaire only control group (M = 17,399 gallons) was not significantly different from the no questionnaire control group (M = 19,402) ($t = .87$, $p > .75$). Apparently, simple completion of the questionnaire did not arouse conservation behavior.

Pledge Signing Effect. Basic analysis of the experimental conditions did not reveal differential rates of water consumption by pledge type, e.g., family vs. individual sign-up. However, it is possible that simply signing or not signing a pledge would affect consumption rate. This possibility was investigated by comparing the consumption rates of the combined control groups to the two no feedback-no reminder (both family and individual pledge) groups. (The consumption rates of both control groups were collapsed since the previous analysis had shown them not to be different.) Thus, the comparison was between those signing and not signing a pledge, but none had received reminders or feedback. The orthogonal contrast revealed a nonsignificant effect ($F < 1$) for signing the pledge. Mean consumption of the no feedback-no reminder pledge groups (family and individual) was 17,716 gallons, while for the control groups mean consumption was 18,400 gallons. Apparently, the simple act of signing a pledge, either individual or family, did not significantly affect conservation behavior.

Feedback vs. Control. The a priori logic for testing the effect of the feedback condition called for a comparison between the feedback-no reminder groups and the no feedback-no reminder groups. That analysis revealed a significant effect, supporting Hypothesis I. However, the

consumption rate of the feedback-no reminder groups should also be different from the control groups' consumption rates to demonstrate the efficacy of the feedback condition. The orthogonal contrast of control group consumption rate (M = 18,400 gallons) showed it to be significantly different from the feedback-no reminder groups' consumption rate (M = 15,239 gallons) ($F = 3.75$, $p < .07$). The level of significance in this test was similar to the a priori comparison between the feedback-no reminder and no feedback-no reminder groupings. Therefore, we can conclude that the differential consumption rates was not due to a questionnaire by experimental condition interaction effects.

Reminder vs. Control. An orthogonal contrast of control group consumption to the no feedback-reminder groups was also performed in order to check further for the efficacy of the reminder condition. The analysis revealed that the control groups' consumption rate (M = 18,400 gallons) was significantly different from the no feedback-reminder groups' consumption rate (M = 14,542 gallons) ($F = 5.59$, $p < .05$). Again, the efficacy of the reminder condition in reducing water consumption did not depend on sensitization by the questionnaire.

As a summary statement, the contrasts of the experimental conditions to the control conditions supported the conclusion that differential rates of water consumption were caused by experimental variables as opposed to intervening or moderating variables.

Blocking Variables. Although the analyses of consumption data by experimental and control conditions supports hypotheses concerning feedback and reminder conditions, it is possible that participant responsiveness to those treatments was affected by individual differences along attitudinal, awareness, or other psychological dimensions. For example, a person who has a positive belief that individual actions make a difference in achieving social goals might be more affected by feedback on water consumption than one who doesn't so believe.

To examine for this possibility all attitudinal and awareness items on the pre-experimental questionnaire were tested for their potential as predictors of water consumption rate. These included items 7-13 and 19-26 in the pre-experimental questionnaire. A stepwise regression procedure was followed, using water consumption rate as the dependent variable. The analysis revealed that only item 13 ("To what extent will water conservation by individual citizens help the shortage.") and item 26 ("Are the attempts at weather modification effective?") were significantly related to water consumption rate.

Each of the four point scales were converted into dichotomous two point scales by combining respondents answering with a one or a two into one category and those answering with a 3 or a 4 into a second category. Three separate ANOVAS were then run in which the two blocking variables

were analyzed in conjunction with one of the experimental variables in a 2 x 2 x 2 between subjects analysis. The total water consumption during the eight week experimental period was used as the dependent variable. The previous year's consumption was used as a covariate. This procedure revealed that neither item 13 nor 26 interacted with the experimental condition effects. The analyses did reveal, however, that items 13 and 26 have a direct impact on water consumption rate (even though their impact did not interact with the experimental variables). This analysis is shown in Figure 3. When participants believed that water conservation by individual citizens would not help the water shortage problem, their belief about the effectiveness of weather modification (cloud seeding) affected their actual consumption rate. Consumptions rate for these participants was significantly less when they believed weather modification would help ($\bar{X}$ = 14,252) than when they believed it would not help ($\bar{X}$ = 18,739) ($F = 5.54$, $p < .05$).

Post Hoc Analyses. The basic 2 x 2 x 2 x 2 analysis of variance with repeated measures on the experimental time periods variable yielded two near significant interactions ($p < .06$). The first interaction was a feedback by reminder by pledge-type interaction, $F(1,139) = 3.78$, $p < .06$. (Figure 4 depicts the interaction.) The pattern of the interaction reveals that in the family-pledge conditions the same configuration of results occurred as in the feedback by reminder interaction discussed previously. That is, water consumption was lowest in the feedback-no reminder condition and the no feedback-reminder condition. However, in the individual-pledge conditions the pattern changed. In the no feedback conditions water consumption was about the same whether or not a reminder was given. (Interestingly, in the feedback conditions consumption was lower when no reminder was given, matching this aspect of the results in the family sign-up conditions.) Indeed, the major difference in the pattern of results across the family versus individual independent variables was the water consumption in the reminder conditions. When the family received the pledge, consumption was much higher in the feedback-reminder condition than in the no feedback-reminder condition. Conversely, in the individual pledge conditions water consumption was almost identical whether or not feedback was given, if a reminder was also given.

The second interaction of interest was a reminder by pledge-type by period effect, $F(1,139) = 3.79$, $p < .06$. (Figure 5 depicts the interaction.) Viewing Figure 4, one finds that in Period 1, little variation occurred among the means. However, during Period 2 those in the family condition not receiving reminders tended to use large quantities of water (M = 19,534 gallons) while those in the individual condition and not receiving reminders used substantially less water (M = 15,300 gallons). Thus, the interaction among the pledge-type and reminder conditions was moderated by the time period, such that the effects occurred only after four weeks of the experiment had elapsed.

Item 26
Belief about weather modification helps or doesn't help

Item 13 Belief about conservation by individual citizens	Helps Alleviate Shortage	Doesn't Help Alleviate Shortage
Helps Alleviate Shortage	M = 15,562	M = 16,732
Doesn't Help Alleviate Shortage	M = 14,252*	M = 18,739*

*difference significant at $p < .05$ ($F = 5.54$)

FIGURE 3. Effect of Two Personal Beliefs--Individual Water Conservation Effort and Weather Modification Effectiveness--on Water Consumption Rate

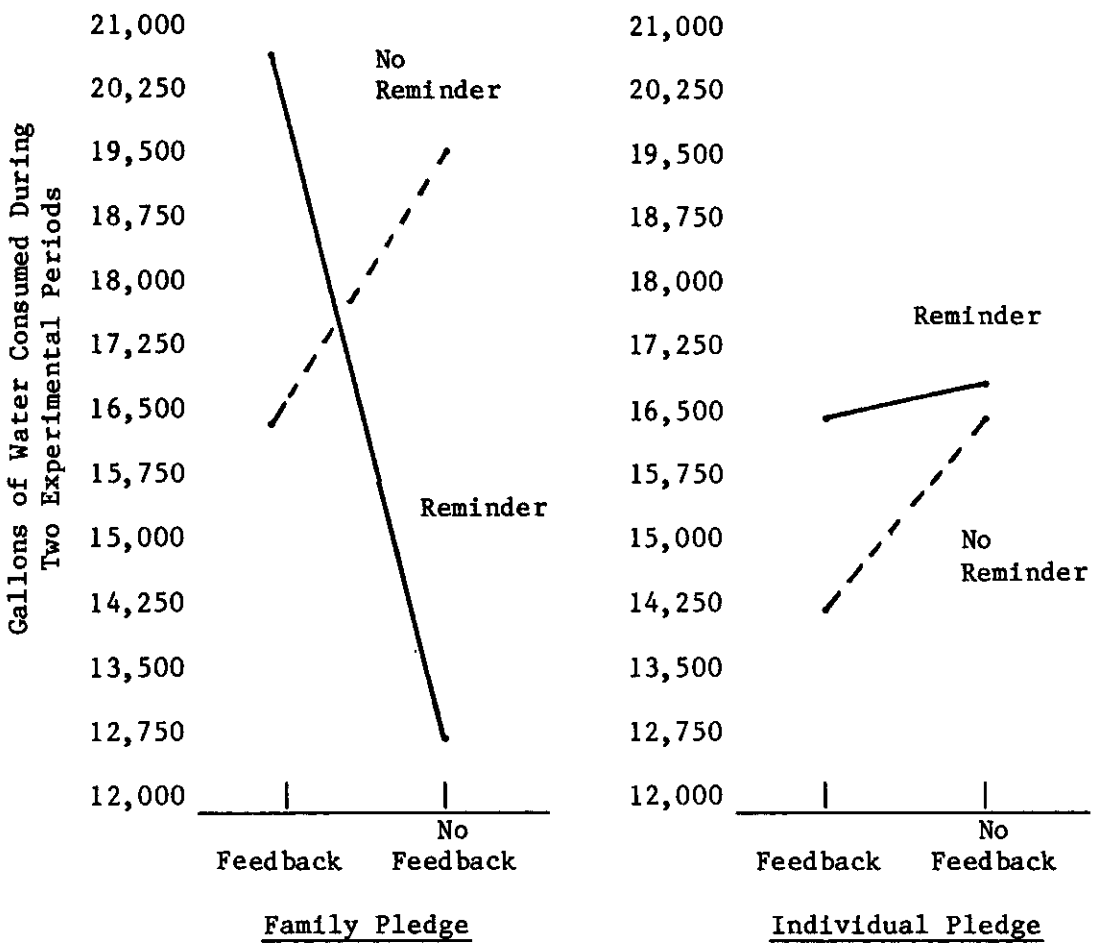


FIGURE 4. Feedback by Reminder by Pledge Interaction

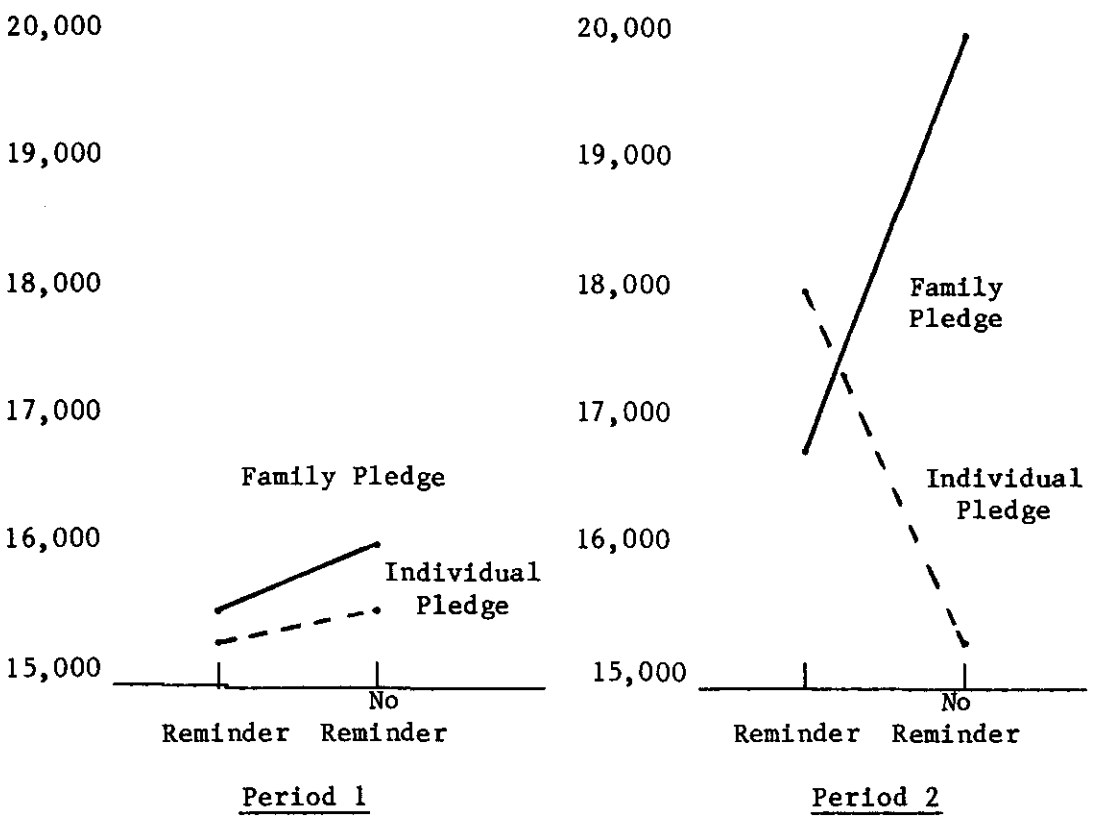


FIGURE 5. Reminder by Pledge by Period Interaction

Overview of ANOVA Results

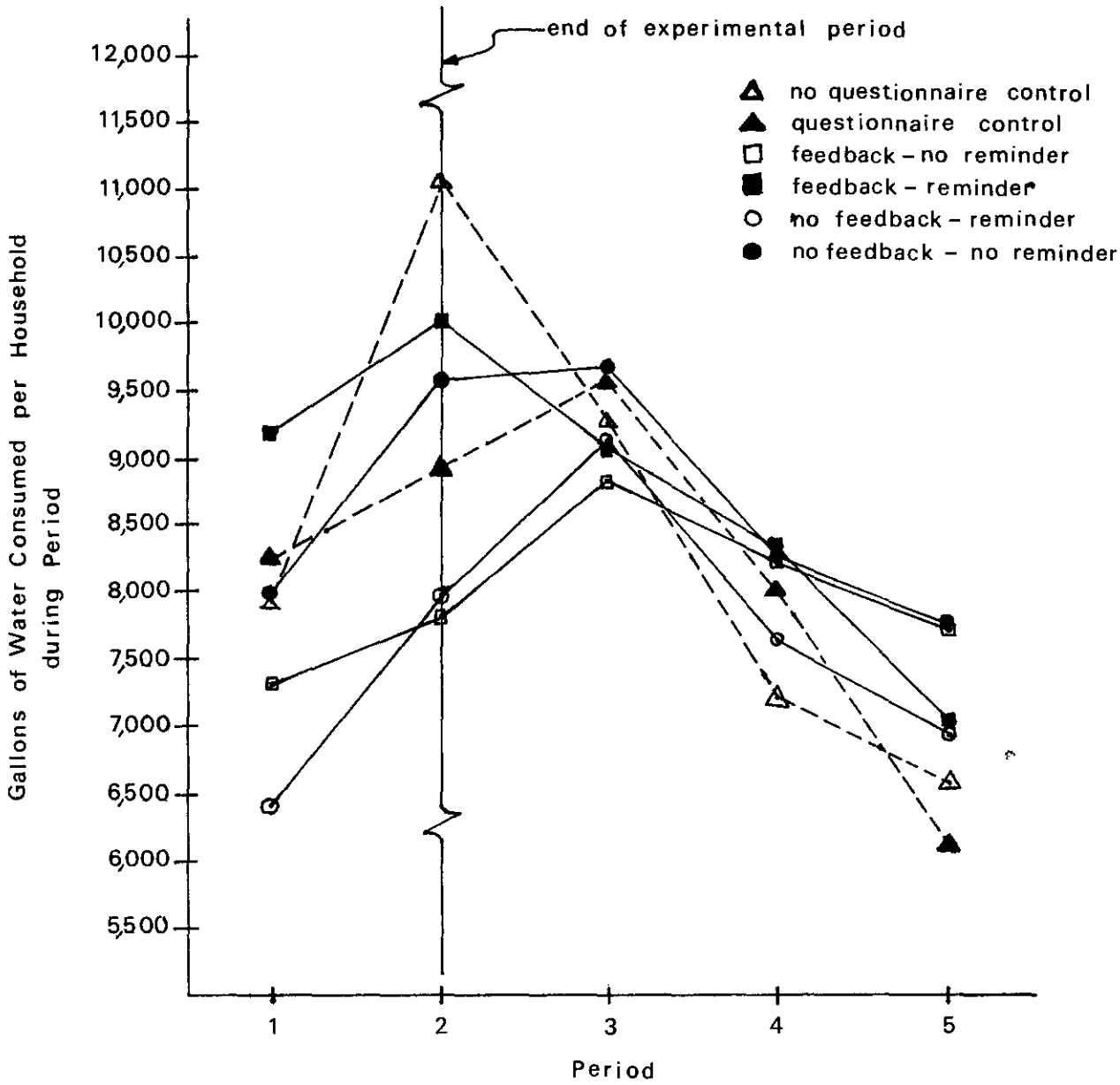
Figure 6 portrays several important aspects of the data. First, the feedback by reminder interaction, depicted in Figure 1, can be seen. For Periods 1 and 2, water consumed in the feedback-no reminder and the no feedback-reminder conditions was substantially less than that consumed in the no reminder-no feedback, the reminder-feedback conditions, and the control conditions.

The second important aspect of the data shown in Figure 6 is the manner in which conditions converged during the follow-up reading periods. Analyses of each follow-up period revealed no significant effects (all p's > .10). Thus, upon the completion of the study, the effect found during the two experimental periods disappeared and the water consumption of the participants converged. The only effect found in the post-experiment periods was a tendency for water use by all users to decrease (particularly in the third and fourth periods).

The third piece of information revealed by Figure 6 concerns the water consumed by the control groups. A comparison of the control groups reveals water consumption in each group to be highly similar, except in the second period of the study. In the second period, participants in the no-questionnaire control group utilized more than 2,000 additional gallons of water per month than did participants in the questionnaire control group. However, a post hoc analysis using the Newman-Keuls procedure revealed this difference to be not significant. Comparing the control groups to the exerimental groups reveals that in the first two periods, water consumption in the control groups was more like that found in the feedback-reminder and the no feedback-no reminder conditions than in the remaining two conditions. In periods three, four, and five the control conditions tend to converge with the other conditions. Such a converging effect of the treatment and control conditions supports the hypotheses that the significant effects found result from the experimental manipulations and not from some unexplained confounding variable.

Attitudes and Awareness of Conservation. In the preliminary questionnaire a series of questions were asked regarding participants current and anticipated water conservation practices. Table 5 presents a summary of the current and anticipated practices of the sample as of May and June 1979.* Of the nineteen practices mentioned, 61.1 percent of the participants were already performing the conservation behaviors

*A number of questions were included in the survey at the request of the Stillwater City Manager's Office. Results of these questions are omitted from the report.



F I G U R E 6

Average Gallons of Water Consumed by Residents
During Five Monthly Periods of the Study

TABLE 5

Preliminary Questionnaire:
Water Conservation Practices in May-June 1979

		Percentage Having Taken Action	Likelihood of Taking Action in the Future[2]
1.	Installed flow control devices.	18.0%	3.5%
2.	Lowered shower volume.	62.3%	2.9%
3.	Insulated hot water pipes.	34.7%	3.8%
4.	Checked for dripping faucets.	94.3%	2.0%
5.	Checked for running toilet.	96.0%	1.9%
6.	Place quart bottle in flush tank.	17.3%	2.6%
7.	Put gray water in toilet.	7.9 %	4.4%
8.	Avoid using toilet as trash basket.	95.5%	1.1%
9.	Wash only full laundry loads.	93.5%	2.2%
10.	Wash only full dish loads.	97.7%	1.7%
11.	Take showers rather than baths.	66.4%	4.0%
12.	Turned off shower while soaping hair.	40.4%	3.7%
13.	Turned off water while brushing teeth.	63.1%	2.9%
14.	Reduced usage of garbage disposal.	61.2%	3.6%
15.	Avoided rinsing dishes unnecessarily.	58.5%	3.3%
16.	Used drip irrigation.	46.6%	3.5%
17.	Used less water when washing car.	76.1%	1.8%
18.	Used broom to clean driveway.	79.2%	2.8%
19.	Put hills around shrubs.	53.5%	3.7%

[1] $N = 177$.

[2] Based on 5-point scale, with 1 = very likely and 5 = very unlikely. N is 177 minus those who were currently taking action.

prior to the study. Table 6 presents the results of questions 7 through 13 and question 19. These dealt with respondents' perceptions of the water shortage in Stillwater and of potential actions which could be taken to alleviate the shortage. Twenty percent of the participants felt that the water shortage in Stillwater was extremely severe or severe. Most thought the shortage to be only moderate (49.7 percent). When asked what would happen in 1980 if nothing were done to influence the water supply, 47.7 percent felt the water shortage would become either extremely severe or severe. Thus a tendency existed for people to feel that the drought would become worse if something were not done. This tendency is confirmed by the mean responses to the questions. The mean response to the current drought conditions was 3.18 and the future conditions was 2.59 indicating a belief that they would grow worse if something was not done.

When asked to rank the importance of factors causing the water shortage, most thought the major cause was a lack of rain (46.8 percent), followed by inadequate treatment facilities (18.5 percent), and inadequate safeyield from lakes (11.6 percent). Generally, the participants did not believe the major cause to have been overuse of water by industry (4.0 percent) or an increase in the population (8.7 percent). Participants did not believe that water consumption should be limited by reducing the growth of the city with 64.7 percent answering no or definitely no to the question. When asked if wet summers in 1979 and 1980 would help the shortage most felt that it would. Only 13.7 percent of the respondents indicated that wet summers would only slightly help or not help at all. Respondents were asked to rank several actions that the City could take to help reduce the problem. Somewhat surprisingly 42.7 percent listed limiting city growth first, followed by eliminating the washing of cars (31.6 percent). The concept of limiting city growth clearly yields a bimodal response as 52.9 percent of the respondents rated this option as the least desirable. The second most often mentioned response was raising water rates (52.0 percent). Indeed, if the top two ranked choices are combined, raising water rates received the highest ranking of 66.6 percent. The idea of raising water rates clearly was not repugnant to the residents participating in the study.

On Question 13 the experimenters sought to identify the extent with which the participants felt that their personal actions would influence the water shortage. The results of the question indicated that 75.7 percent indicated that their actions would definitely or somewhat help. Question 14 asked subjects to what extent their family would take steps to limit water usage. Seventy-nine point one percent indicated that they would do most or some of the conservation steps listed in Table 5. Note that the results of Question 14 did not account for a significant amount of the variance in the water consumption data. Thus, in this case behavioral intentions were not an indicator of water usage.

TABLE 6

Preliminary Questionnaire:
Water Shortage Perceptions

Question

7. How severe is the water shortage right now in Stillwater? N = 175

1-1.7%	2-18.8%	3-49.7%	4-18.9%	5-10.6%
extremely severe	severe	moderate	somewhat	not at all severe

8. If we do nothing to influence the water supply in Stillwater, how severe will the water shortage be in 1980, assuming normal rainfall? N = 174

1-17.8%	2-29.9%	3-33.3%	4-12.6%	5-6.3%
extremely severe	severe	moderate	somewhat	not at all severe

9. Rank the below areas in importance in their contribution to the water supply shortage. N = 173

	Rank (percentage)				
	1	2	3	4	5
a. lack of rain--drought	46.8%	3.5%	3.5%	17.4%	3.5%
b. inadequate treatment facilities	18.5%	5.9%	8.8%	18.6%	18.7%
c. inadequate safe yield from lakes	11.6%	10.6%	17.6%	25.0%	25.1%
d. overuse of water by public	10.4%	13.5%	11.8%	26.7%	24.0%
e. overuse of water by industry	4.0%	35.3%	26.5%	10.5%	15.2%
f. increase in size of population of Stillwater	8.7%	31.2%	31.8%	1.7%	13.4%

10. Should the City of Stillwater actively limit its growth as a way of limiting the water consumption? N = 176

1-4.5%	2-17.0%	3-13.6%	4-45.4%	5-19.3%
definitely yes	yes	maybe	no	definitely no

11. If the summers in 1979 and 1980 are wet, to what extent will that help the water shortage problem? N = 176

1-4.0%	2-45.4%	3-36.9%	4-11.4%	5-19.3%
eliminate problem	help problem	somewhat help problem	slightly help	not at all help

12. Rank the below methods in terms of what you think the City should do to deal with the water supply problem until the new pipeline is built? N = 171

	Rank (percentage)			
	1	2	3	4
a. raise water rates	14.6%	52.0%	19.3%	15.9%
b. limit watering lawns to certain times	11.1%	34.0%	46.8%	7.1%
c. eliminate washing cars	31.6%	12.3%	29.2%	24.1%
d. limit city growth	42.7%	1.7%	4.7%	52.9%

TABLE 6 (Cont.)

13. To what extent will water conservation by individual citizens, such as yourself, help to alleviate the water shortage in Stillwater? N = 177

1-38.4%	2-36.3%	3-23.7%	4-.56%
definitely help	somewhat help	help a little	have no impact

19. To what extent will your family take steps to limit water usage? N = 177

1-36.7%	2-42.4%	3-14.1%	4-5.6%	5-1.1%
will do most of steps listed	will do some of steps listed	will do a few of steps listed	will do 1 or 2 of steps listed	do not intend to limit water usage

NOTE: The rank percentages in question 9 are the percentage of people who ranked each area as contributing the most to the 5th most to the water shortage. In question 12 the rank percentages represent the percentage of people who ranked each possible solution to the water shortage from 1st to 4th.

Table 7 presents the results of the questions dealing with participants' perception of droughts (Questions 20-26) and of recent rainfall in Stillwater. Overall participants felt that: rainfall in Stillwater had recently been wetter than usual (46.5 percent), that over the past five years Stillwater has received an average (56.7 percent) amount of rainfall, that a 1930s style drought probably will occur again (37.7 percent), that the chances of a drought the next summer are less than one in ten (23.3 percent), that droughts occur about as frequently as they used to (40.7 percent), and that they doubt the effects of weather modification (41.6 percent). In general the participants appear to be slightly over optimistic about the possibility of avoiding droughts in the future.

In the follow-up questionnaire the experimenters sought to check the effectiveness of the manipulations and obtain information on attitudes which may have been influenced by the experiment. The manipulation checks revealed the experimental inductions to have been effective. Subjects reported reading the feedback form every week (79 percent) or almost every week (12 percent). Those subjects receiving the reminder form reported reading them every week (45 percent) or almost every week (16 percent). One sees a trend, however, for the feedback forms to have been noted to a greater extent than the reminder forms. Indeed, 24 percent of the subjects reported not reading many of the reminder forms.

In several questions the experimenters attempted to determine the subject's perceptions of how hard they tried to limit water consumption and how the respondents felt about participating in the study. Table 8 presents these results. Questions 3 and 4 asked subjects how hard they or their family tried to lower consumption during the study. The individuals tended to indicate that they did more to lower consumption than other family members. In particular only 12 percent indicated that they did not think much about conservation while 23 percent indicated that their family members did not think much about conservation. On question 19 subjects responded to a similar question asking about family efforts. Here 18 percent were said to not have paid attention to water usage or to have not wanted to reduce consumption.

When asked about how they felt about participating in the study in only one case did an individual indicate an unfavorable reaction and in only one case was there an unfavorable reaction from family members. When asked if participating in the study changed their water usage (Question 10), 60.3 percent indicated that they used less as a result of the study. No one indicated that they used more.

Question 20 asked to what extent were subjects now attempting to limit water consumption, most said they were still doing things to limit water usage (78.4 percent). These percentages are roughly equivalent to those found on the questions asking subjects what they and their

TABLE 7

Participants General Perceptions of Rainfall and Drought*

Question					
20. Over the past few months, the rainfall in Stillwater has been: N = 177	1-5.3% much drier than usual	2-8.5% drier than usual	3-35.3% average	4-46.5% wetter than usual	5-1.1% much wetter than usual
21. Assuming that we have average rainfall over the next four years, will Stillwater have enough water? N = 177.	1-1.1% definitely yes	2-26.0% yes	3-38.4% don't know	4-32.2% no	5-2.3% definitely no
22. Considering the rainfall over the past five years, rate the extent of drought conditions in the Stillwater area. N = 164	1-1.8% very dry	2-40.2% dry	3-56.7% average	4-1.2% wet	5-0% very wet
23. Do you think a drought like the 1930s will ever occur again? N = 175	1-13.7% definitely will	2-37.7% probably will	3-20.6% probably won't	4-6.9% will not	5-21.2% don't know

24. What are the chances of a drought next year? N = 168	1-23.2% less than	2-19.6% 1 in 10	3-13.1% 2 in 10	4-9.5% 3 in 10	5-4.2% 4 in 10	5-14.9% 5 in 10	7-15.5% other

25. Do you think that droughts are becoming more or less frequent? N = 177	1-13.6% more	2-40.7% no difference	3-23.2% less	4-22.6% don't know

26. What do you think of attempts at weather modification? Are they effective? N = 172	1-5.2% strong belief	2-38.7% belief	3-41.6% doubt	4-13.9% strong doubt

*N's differ because some individuals refused to answer when they believed they had no idea.

TABLE 8

Follow-Up Questionnaire:
Respondents' Perceptions of Study and
Water Conservation Efforts

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3. Thinking back to last summer, to what extent did you, yourself try to lower your family's water usage? N = 137
   A. Worked hard to reduce consumption--26%
   B. Did some things to reduce consumption--61%
   C. Did not think about it much--12%

4. To what extent did your family members try to lower their water usage? N = 123
   A. Worked hard to reduce consumption--26%
   B. Did some things to reduce consumption--57%
   C. Did not think about it much--23%

5. Overall, how did you feel about participating in the water study? N = 136
   A. Very favorable--29%
   B. Somewhat favorable--43%
   C. Neutral--27%
   D. Somewhat unfavorable--0
   E. Unfavorable--.73%

6. How did the other family members feel about participating in the water study? N = 126
   A. Very favorable--24%
   B. Somewhat favorable--38%
   C. Neutral--34%
   D. Somewhat unfavorable--1.5%
   E. Unfavorable--.79%

10. Overall, do you think that having participated in the study changed how much water you used in any way? N = 139
   A. Used much less--4.3%
   B. Used less--56%
   C. Used same--38%
   D. Used more--0%

18. To what extent will water conservation by individual citizens, such as yourself, help to alleviate the water shortage in Stillwater? N = 138
   A. Definitely help--48.5%
   B. Somewhat help--29.0%
   C. Help a little--20.3%
   D. Have no impact--2.2%

19. To what extent did your family try to limit water usage last summer? N = 143
    A. Tried hard to keep consumption down--20%
    B. Did a few things to lower consumption--61.5%
    C. Did not pay much attention to our water usage--16%
    D. Did not want to lower water usage--2%

20. To what extent are you now trying to lower your water consumption? N = 148
    A. Trying hard to keep consumption down--16.9%
    B. Doing a few things to lower consumption--61.5%
    C. Not paying much attention to our water usage--17.6%
    D. Do not want to lower water usage--4.1%

21. In general, how favorable or unfavorable do you feel about water conservation? N = 164
    A. Very favorable--43.3%
    B. Favorable--40.2%
    C. Neutral--7.3%
    D. Unfavorable--7.3%
    E. Very unfavorable--1.8%

22. Rate the extent which you agree or disagree with the following statement. All Americans must personally make sacrifices to reduce their usage of natural resources. N = 152

Strongly Agree	1	2	3	4	5	Strongly Disagree
	63.8%	23.7%	9.2%	2.0%	1.3%	

23. Did your participation in the study alter or change your feelings about conservation of natural resources in general? N = 137

Changed in favor of conservation	1	2	3	4	5	Changed to view conservation more negatively
	18.2%	24.1%	56.9%	1%	0%	

families were doing during the study. A general question was asked of subjects concerning their overall attitude towards water conservation. Here only 9.2 percent stated an unfavorable attitude. Eighty-three point five percent said they were either very favorable or favorable.

Each of the above questions was analyzed to determine if the experimental treatments had any significant impact on the responses. No such effects were found.

In one case exactly the same question was asked in both questionnaires. The question dealt with the efficacy of individual action. The results indicate a small tendency for those completing the second questionnaire to have an increased belief in the effects of individual actions. In the second questionnaire 48.5 percent of the subjects said that personal action would "definitely help" while in the first questionnaire 38.4 percent made such a statement.

Question 22 broached the general question of whether Americans must make personal sacrifices to reduce their use of natural resources. Almost 64 percent of the subjects strongly agreed with it and only 1.3 percent strongly disagreed. The final question asked subjects to indicate whether participation in the study affected their attitudes towards conservation. Forty-two percent of the subjects indicated that their attitudes had changed positively. Only one individual indicated that they became more negative.

Discussion

The present study extends previous research on energy conservation and other environmentally relevant behaviors into the related area of water conservation. The findings confirm and support those in the literature concerning the beneficial effects of providing feedback and prompts to reduce consumption activity. However, the study also revealed that the combination of providing both feedback and reminder may have a deleterious impact on conservation. Examination of the interaction portrayed in Figure 1 shows that consumption was high (as expected) when the household received neither feedback nor reminders and low (as expected) when the household received either feedback or reminder information. The finding of high water consumption when both feedback and reminders were given was unexpected.

A possible explanation for the high water consumption in the feedback plus reminder condition is the presence of a wearout effect (Appel 1971, Corkindale and Newall 1978). Craig, Sternthal, and Leavitt (1976) found evidence for wearout in the form of decreased recall when precautions were not taken to insure subjects' attention. The authors also suggested that psychological reactance (Brehm 1966) may occur at high levels of repetition. Reactance theory proposes that individuals will

seek to restore their behavioral feedom when they perceive it to be endangered. In the present study the combination of frequent feedback and reminders may have been perceived by subjects to violate their freedom to use water, resulting in reactance and increased water usage.

The effects of the feedback and reminder conditions are even more striking when one examines them over the five data collection periods. The no questionnaire control group consumption pattern reflects the cyclical nature of water use, showing a rapid increase during the hot, dry portion of the summer. The consumption rate then decreased as the growing season gradually ended, coming to rest at a relatively stable rate of approximately 7,000 gallons per month. Generally, the feedback plus reminder and no feedback-no reminder groups reflect the normal pattern, although consumption was slightly lower during the experimental period (not significantly different).

However, the feedback only and reminder only groups reflect a quite different pattern in two respects. First, they are the lowest consumption groups, and show a parallel pattern with each other. Second, consumption in these groups increased between the end of the experimental period and the first follow-up measurement. These data suggest that a normal use pattern for water consumption exists, and that feedback alone and reminder alone did affect that pattern. When these conditions were discontinued, the residents' water use converged upward to the normal consumption pattern.

Two public policy implications can be drawn from this study. First, residential households can be overexposed to conservation appeals. As discussed above, similar effects have been found in marketing research on advertising wearout. With the present data revealing that either reminders or feedback information reduces consumption, a choice between the approaches is necessary. Since a reminder approach is less costly than providing systematic feedback, it would appear to be the preferred alternative, particularly when a specific consumption goal is specified, as in the present case.

Second, water conservation is somewhat different from energy conservation. Energy conservation approaches often contain elements of technological adjustments (insulation, automobile efficiency, solar heating, etc.) that more or less permanently alter consumption needs. Therefore, behavioral approaches may induce one to purchase the technology and result in long lasting conservation effects. However, water conservation approaches for residential users do not tend to have the diversity of such technological elements. (The various flow control devices represent the basic new technology available in the water conservation area.) One becomes committed to a certain level of water use due to hygenic, physical, and landscape factors. Reduced water consumption, therefore, tends to be more feasible in the short run than in the

long run. In particular, behavioral approaches to lower consumption may be most effective in times of water crises (drought), with consumption expected to return to normal levels when the behavioral approach is discontinued. The results of the follow-up readings support such a hypothesis.

A final issue concerns the effects of the pledge-type variable. Although no significant main effects were found for pledge-type, the data suggests that this variable may have interacted with the feedback and reminder conditions. That is, when the pledge is made by a single adult member of the family, water consumption is lowest when feedback is provided. However, when the pledge is made by all members of the family, water consumption is lowest when reminders are given. It may be that the important activity for "individuals" signing a pledge is the goal contained in that pledge, and hence the feedback relation to goal achievement is most relevant. Alternatively, the important activity for "families" signing a pledge may be the feelings of group interaction, and hence the reminder acts as a catalyst for that feeling. Additional research needs to be conducted to explore these speculations.

These conclusions must, of course, be viewed with the limitations of the research in mind. The primary threat to the study was the unpredictable nature of weather fluctuations. The study was designed at a time when water reservoir levels had declined to the lowest point in many years and when the City Council had reached a decision to ask residents to reduce their consumption by 10 percent. However, during the experiment, rainfall returned to normal levels, even though the reservoirs remained at critically low levels. Thus, while the 10 percent water reduction goal was still publicized, the climatic conditions may have interacted with the behavioral approaches in unknown ways. Still, the fact that the feedback and reminder conditions at least temporarily suppressed consumption rates in the face of such conditions was encouraging.

Summary and Recommendations

The present study extends behavioral research into the area of water conservation. Although behavioral research has been conducted in other man-environment relationships, very little has been done relative to similar issues involved in water conservation. The findings of this study have potentially important implications for public agencies seeking effective water conservation programs.

Summary of Research Findings

The findings generally confirm and support those in the literature concerning the beneficial effects of providing feedback and prompts to reduce consumption activity. Two hundred Stillwater residential house-

holds were differentially presented with feedback regarding their weekly rate of water consumption and reminders which restated the importance of water conservation. Examination of the data revealed that (see Figure 2, p. 28) consumption was high when households received neither feedback nor reminders, and also high when households received both feedback plus reminders. However, water consumption was low when either feedback (alone) or reminders (alone) were give to the households (see p. 41).

Research Conclusion 1. The analysis supports the conclusion that either weekly feedback or weekly prompts may induce residential households to reduce their rates of water consumption.

The third independent variable examined in this study was manipulated in order to determine if the manner in which the conservation decision was made affected the rate of family water consumption. Either one adult household member or the entire family was asked to sign a pledge to reduce water usage by 10 percent. Previous literature suggested that participative decisions tend to commit individuals to those decisions and enhances motivation to achieve decision-related goals. Analysis of the data revealed no difference in water consumption rates between individual adult decision and participative family decision groupings (see p. 41).

However, analysis of the consumption data revealed that the effects of the reminder and feedback treatments had near significant interactions with pledge type and time period variables. It was found that residents whose "family" signed the pledge were more inspired to conserve water when receiving only a reminder (p. 47, 48). Alternatively residents whose pledge was signed only by one adult member, were more inspired to conserve water when receiving only feedback (p. 47, 48).

The interactive effect of the reminder treatment with pledge-type was differentially affected during the two experimental periods. That is, while residents receiving both pledge-type treatments consumed approximately the same amount of water in the first four weeks, there was substantial difference in the second four weeks. In the second period "family" water consumption was least in the reminder condition but "individual" consumption was least in the no reminder condition (p. 47-49).

Research Conclusion 2. The manner in which families agree and commit themselves to water conservation may affect their responsiveness to various other public efforts to induce conservation behaviors. "Family" commitments appear to make the family more responsive to an educational approach (reminder-prompt). "Individual" commitments appear to make the family more responsive to a feedback approach. Further, these differential responses may be modified over time.

The data also suggest that the effects of the behavioral variables on water conservation do not extend much past the discontinuance of the manipulations. The follow-up readings revealed no significant differences in the rates of water consumption for any of the ten groupings (p. 52). The data suggest that there is a normal consumption pattern that is affected by variations in weather and need variables. The behavioral variables tended to influence that pattern, increasing the variance in consumption between groupings due to decreased consumption in some groups, but the pattern was reestablished by all groups immediately following discontinuance of feedback and reminders (p. 51).

Research Conclusion 3. There seems to be a normal water consumption pattern which can be influenced in the short-run by introducing reminder or feedback variables. Such influence is not likely to persist beyond discontinuance of the variables.

A number of individual characteristics are often suspected to interact with public efforts to induce water conservation. For instance, individuals with one type of attitude might be more likely to be influenced by reminders than other individuals with different attitudes. A number of individual characteristics along attitudinal, awareness and other psychological dimensions were measured in the pre-experimental questionnaire. Other individual characteristics such as previous history or rate of water consumption were separately assessed.

Analyses revealed that two individual beliefs had a direct impact on rate on water consumption. These beliefs were whether the subject believed individual conservation efforts would help alleviate the water shortage, and whether weather modification efforts would help. The results indicated that when subjects believed that something (either by one's self or by another) could be done to ease the water shortage they were more likely to respond to conservation efforts than when they believe nothing could be done (p. 45). Apparently, if individuals believe that the water shortage is simply a matter of fate, they are not easily inspired to conserve water. However, if they believe that the water shortage can be affected by either their own efforts (conservation) or by someone else's efforts (weather modification) they are more easily inspired to conserve water.

Research Conclusion 4. Individuals, who believe that either their own or another's efforts can affect water shortage are more likely to conserve water than are individuals who do not so believe.

The experimental variables did not appear to differentially affect or change any attitudes of the subjects (p. 62). However, subjects reported having favorable attitudes toward water conservation following completion of both the experimental and follow-up periods (p. 62). In fact, 42 percent of all subjects indicated that their attitudes toward

conservation were positively improved as a result of participating in the study (p. 63).

Research Conclusion 5. The introduction of specific behavioral variables may not affect specific attitudes. However, participating in conservation efforts may be expected to positively improve general attitudes toward water conservation.

An important question concerns how much water consumption can be reduced through the introduction of water consumption feedback conservation reminders.

Research Conclusion 6. The goal-related feedback approach appears to achieve between a 14.4 percent (comparing water consumption in the feedback only group to consumption in no feedback/no reminder groupings) and a 21 percent (feedback only vs. no questionnaire control groupings) reduction in water consumption. The informational reminder approach appears to achieve between 17.6 percent (reminder only vs. no feedback/no reminder groupings) and 24.6 percent (reminder only vs. no questionnaire control groupings) reduction in water consumption (p. 41-42).

Recommendations

The research conclusions lend themselves well to several specific recommendations having potential value to municipal bodies concerned with enhancing water conservation. The recommendations discussed below are limited to those which the research strongly suggests. In addition, certain limitations of the study should be kept in mind. The limitations of the study refer to the ability to comfortably generalize the findings from Stillwater, Oklahoma, to other municipal settings (larger cities, cities with different degrees of industrialization, and cities with different sources of water, etc.) and to other situational settings (different climatical conditions, different severity of water shortage, etc.). The higher the degree of similarity between such municipal and situational settings and the conditions existing within Stillwater, Oklahoma (at the time the study was conducted) the more likely the findings are to generalize.

Recommendation 1. Municipal water agencies are often faced with water shortages that are temporary in nature, as opposed to more permanent. In conditions of temporary water shortage it may not be necessary to achieve either a permanent reduction in water consumption or a permanent increase in water storage capacity. Rather, a temporary decrease, ranging from about 14 percent to 24 percent, in normal water-use patterns may be achieved with the introduction of either goal-related feedback or informational reminders. Goal-related feedback is implemented by first setting a specific city-wide water conservation target (e.g., 10 percent reduction in use) and then providing weekly feedback to residents regarding their actual rate of water consumption relative to the target.

Recommendation 1a. Municipal water agencies should avoid the urge to overload citizens with too many behavioral approaches. If residents receive both goal-related feedback and informational reminders, steps should be taken to insure that consumers view the information favorably and do not react against it.

Recommendation 1b. If the municipal water agency does not visit with or solicit residents' commitments to the conservation target, their choice between the goal-related feedback approach and the informational reminder approach should be based on cost/benefit analysis or other practical considerations regarding the ease of implementation.

Recommendation 2. Simply soliciting residents' commitments to the conservation target is not a sufficient approach to induce water conservation. However, such solicitation may be an important preceeding event which facilitates the effectiveness of either the goal-related feedback or informational reminder approaches. If the municipal water agency does solicit residents' commitments to a water conservation target, the choice between goal-related feedback and informational reminder approaches should be based only in part on cost/benefit analyses and other practical considerations. In addition, the choice should be based on an evaluation of the manner in which the residents' commitment decisions were made. If the agreements were made by total "family units," informational reminders are likely to be more effective than goal-related feedback. However, if the agreements were made by "lone adults," goal-related feedback is likely to be more effective than informational reminders.

Recommendation 3. The first two recommendations may be combined into a method which includes both practical and effectivness-of-approach considerations. These two recommendations suggest that an even more effective approach for inducing water conservation during a short-term water shortage would be:

1. Evaluate cost/benefit and other practical considerations to determine whether goal-related feedback or informational reminders are most compatible within the existing water agency procedures.

If goal-related feedback is more compatible, then

2. Establish the conservation target and solicit residential commitment by "lone adult" household heads.

3. Administer weekly goal-related feedback.

If informational reminders are more compatible, then

2. Establish the conservation target and solicit residential commitment by total "family units."

3. Administer weekly reminders.

Recommendation 4. Two general sets of beliefs appear to have direct impact on rates of water conservation. These beliefs are whether the individual believes the water shortage can be affected either by one's own efforts or by another source (such as a weather modifier), or rather whether the individual believes that the water shortage can only be resolved by nature. Individuals believing the former are more likely to exert conservation efforts. Therefore, the effectiveness of behavioral approaches, such as with recommendation 3, may be enhanced by educational efforts whose purpose is to create the belief among individual residents that their individual effort will help achieve the conservation goal of the community. Such a widespread educational effort through public media, should precede the goal-related feedback or informational reminder approaches to avoid overloading residents.

Recommendation 4a. In order to facilitate the belief that individual efforts can make a difference, materials that explain various methods of saving water should be distributed during the educational effort. Such material will increase credibility of the educational effort.

Recommendation 4b. At least one component of informational reminders (if this approach is used) should relate to the importance of individual contributions to community goals.

In summary, this study has shown that municipal water agencies can take specific behavioral approaches during temporary periods of water shortage and achieve a reduction of water consumption ranging from 14 percent to 24 percent. These steps will likely be well received by residents and the conservation goals will likely be achieved without resorting to harsher approaches such as watering restrictions, rate changes or use penalties. When the water emergency is over, the use of goal-related feedback or informational reminders may be discontinued and normal consumption patterns will return. If the conservation target exceeds the 14 percent to 24 percent range, or if the water shortage is more permanent in nature, the behavioral approaches may not achieve the necessary goals.

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APPENDIX I

QUESTIONNAIRE

Age_____ Sex_____

1. How long have you lived in Payne County?

1	2	3	4	5
less than 1 year	1-2 years	3-5 years	6-9 years	10 or more

2. Please indicate the city and state in which you have spent the most years of your life?

3. How many members of your family are now living at home?

___ 1 ___ 2 ___ 3 ___ 4 ___ 5 ___ 6 ___ 7

4. How many bathrooms do you have?

___ 1 ___ 2 ___ 3 ___ 4

5. Do you have an electric dishwasher in your home?

___ Yes ___ No

6. Below are a few things people can do to lower their water usage. Are you presently doing any of these? If not, how likely is it that you would take the action?

___ Installed water flow control devices

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Lowered the volume of water used in showers

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Insulated hot water pipes

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Checked for dripping faucets in the last three months

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Checked for continuously running toilet

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Placed quart bottle in flush tank

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Put gray water in the toilet (not tank)

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Avoided using toilet as trash basket

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Washed only full loads of laundry

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Washed only full loads of dishes

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Taken showers rather than baths

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Turned off shower while soaping hair

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Turned off water while brushing teeth and shaving

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Reduce usage of garbage disposal

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Avoid unnecessary rinsing of dishes before putting in dishwasher

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Tried drip or trickle irrigation on outdoor plants

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Taken care to use less water when washing car

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Use broom, not hose, to clean driveway

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

___ Put small hills aroung trees and shrubs to prevent water run-off

1	2	3	4	5
very likely	somewhat likely	uncertain	somewhat unlikely	very unlikely

7. How severe is the water shortage right now in Stillwater?

1	2	3	4	5
extremely severe	severe	moderate	somewhat	not at all severe

8. If we do nothing to influence the water supply in Stillwater, how severe will the water shortage be in 1980, assuming normal rainfall?

1	2	3	4	5
extremely severe	severe	moderate	somewhat	not at all severe

9. Rank the below areas in importance in their contribution to the water supply shortage.

a. lack of rain--drought ___
b. inadequate treatment facilities ___
c. inadequate safeyield from lakes ___
d. overuse of water by public ___
e. overuse of water by industry ___
f. increase in size of population of Stillwater ___

10. Should the City of Stillwater actively limit its growth as a way of limiting the water consumption?

1	2	3	4	5
definitely yes	yes	maybe	no	definitely no

11. If the summers in 1979 and 1980 are wet, to what extent will that help the water shortage problem?

1	2	3	4	5
eliminate problem	help problem	somewhat help problem	slightly help	not at all help

12. Rank the below methods in terms of what you think the City should do to deal with the water supply problem until the new pipeline is built?

a. raise water rates ___
b. limit watering lawns to certain times ___
c. eliminate washing cars ___
d. limit city growth ___

13. To what extent will water conservation by individual citizens, such as yourself, help to alleviate the water shortage in Stillwater?

1	2	3	4
definitely help	somewhat help	help a little	have no impact

14. Have you ever had personal contact with the water meter readers in Stillwater?

___ Yes ___ No

If yes, how would you judge your contact with the water meter readers?

1	2	3	4	5
extremely helpful	somewhat helpful	neutral	somewhat unhelpful	extremely unhelpful

15. Have you ever had a billing problem or error in your water bill?

___ Yes ___ No

If yes, what was the problem?

_____

_____

_____

Has the problem been resolved to your satisfaction?

1	2	3	4	5
resolved extremely satisfactorily	resolved somewhat satisfactorily	neutral	resolved somewhat unsatisfactorily	resolved extremely unsatisfactorily

16. Do you know of others who have had problems?

___ Yes ___ No

17. Rate your confidence in the management of the Stillwater city government.

1	2	3	4	5
very high	high	neutral	low	very low

18. What should be the policy of Stillwater regarding the growth of the city?

1	2	3	4	5
encourage growth strongly	encourage growth slightly	do nothing pro or anti	discourage growth slightly	discourage growth strongly

19. To what extent will your family take steps to limit water usage?

1	2	3	4	5
will do most of steps listed	will do some of steps listed	will do a few of steps listed	will do 1 or 2 of steps	do not intend to limit water usage

20. Over the past few months, the rainfall in Stillwater has been:

1	2	3	4	5
much drier than usual	drier than usual	average	wetter than usual	much wetter than usual

21. Assuming that we have average rainfall over the next four years, will Stillwater have enough water?

1	2	3	4	5
definitely yes	yes	don't know	no	definitely no

22. Considering the rainfall over the past five years, rate the extent of drought conditions in the Stillwater area.

1	2	3	4	5
very dry	dry	average	wet	very wet

23. Do you think a drought like the 30s will ever occur again?

1	2	3	4	5
definitely will	probably will	probably won't	will not	don't know

24. What are the chances of a drought next year?

1	2	3	4	5	6	7
less than 1 in 10	1 in 10	2 in 10	3 in 10	4 in 10	5 in 10	other

25. Do you think that droughts are becoming more or less frequent?

1	2	3	4
more	no difference	less	don't know

26. What do you think of attempts at weather modification? Are they effective?

1	2	3	4
strong belief	belief	doubt	strong doubt

27. In the recent Stillwater water bond issue were you generally in favor or against the issue?

1	2	3	4	5
strongly in favor	moderately in favor	undecided	moderately against	strongly against

28. Did you vote in the election?

___ Yes ___ No

29. Will you be taking a vacation this summer?

___ Yes ___ No

30. If yes to question 29, when and how long?

31. Do you own or rent your house?

___Own ___Rent

APPENDIX II

Water Project

Questions For Follow-Up

Last summer you participated in a research study investigating water conservation. We would like to ask you some questions about how you felt about your participation.

1. We gave you a form each week which compared your water usage to the usage the year before.

   A. Do you remember getting the form?

      Yes _____ No _____

   B. Thinking back, to what extent did you take note of the information?

      A. Read each week

      B. Read almost every week

      C. Read about every other week

      D. Did not read many of them

   C. Was there anything which kept you from reading the feedback form?

2. We also gave you a form wich reminded you of the importance of water conservation.

   A. Can you remember receiving such a form?

      Yes _____ No _____

   B. Thinking back, to what extent did you take note of the information?

      A. Read each week

      B. Read almost every week

      C. Read about every other week

      D. Did not read many of them

   C. Was there anything which kept you from reading the feedback form?

3. Thinking back to last summer, to what extent did you, yourself try to lower your family's water usage?

   A. Worked hard to reduce consumption

   B. Did some things to reduce consumption

   C. Did not think about it much

4. To what extent did your family members try to lower their water usage?

   A. Worked hard to reduce consumption

   B. Did some things to reduce consumption

   C. Did not think about it much

5. Overall, how did you feel about participating in the water study?

   A. Very Favorable

   B. Somewhat Favorable

   C. Neutral

   D. Somewhat Unfavorable

   E. Unfavorable

   Comments: _____

   _____

   _____

6. How did the other family members feel about participating in the water study?

   A. Very Favorable

   B. Somewhat Favorable

   C. Neutral

   D. Somewhat Unfavorable

   E. Unfavorable

   Comments: _____

   _____

   _____

7. Who in your family tried the hardest to lower their water usage?

_____

8. Think back to last summer. During the study, how much rainfall did Stillwater have?

   A. Much less than usual

   B. Somewhat less than usual

   C. Average

   D. More than usual

   E. Much more than usual

9. Thinking back, do you feel that the amount of rainfall last summer affected your use of water?

   A. Used much less than usual

   B. Used less than usual

   C. Used same

   D. Use more than usual

   E. Used much more than usual

10. Overall, do you think that having participated in the study changed how much water you used in any way?

   A. Used much less

   B. Used less

   C. Used same

   D. Used more

   Explain: _____

   _____

   _____

11. Did you have a garden last summer?

   Yes _____ No _____

12. Do you have a swimming pool?

   Yes _____ No _____

13. Did you fill the pool last summer?

Yes _____ No _____

14. Did you fill the pool the year before last?

Yes _____ No _____

15. Did you go on a vacation last summer? (1979)

Yes _____ No _____

When _____, How long were you gone? _____ days.

16. Thinking back to the year before, did you go on vacation during July and/or August? (1978)

Yes _____ No _____

How Long? _____ days

17. Did anything unusual happen last summer which might have changed your water consumption?

_____

_____

18. To what extent will water conservation by individual citizens, such as yourself, help to alleviate the water shortage in Stillwater?

A. Definitely help

B. Somewhat help

C. Help a little

D. Have no impact

19. To what extent did your family try to limit water usage last summer?

A. Tried hard to keep consumption down

B. Did a few things to lower consumption

C. Did not pay much attention to our water usage

D. Did not want to lower water usage

What specific things, if any, did you do in your home last summer to cut down or limit water consumption?

_____

_____

_____

20. To what extent are you now trying to lower your water consumption?

A. Trying hard to keep consumption down

B. Doing a few things to lower consumption

C. Not paying much attention to our water usage

D. Do not want to lower water usage

What specific things, if any, are you now doing to cut down or limit your water usage?

_____

_____

_____

21. In general, how favorable or unfavorable do you feel about water conservation?

A. Very Favorable

B. Favorable

C. Neutral

D. Unfavorable

E. Very Unfavorable

22. Rate the extent with which you agree or disagree with the following statement. All American must personally make sacrifices to reduce their usage of natural resources.

Strongly Agree	1	2	3 Neutral	4	5	Strongly Disagree

23. Did your participation in the study alter or change your feelings about conservation of natural resources in general

Changed in favor of conservation	1	2	3 No Change	4	5	Changed to view conservation more negatively