

Use, Perceptions, and Barriers to Water Conservation Strategies for Florida Water Utilities¹

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Executive Summary

Using a survey of representatives of Florida water utilities, we examined the use of and barriers for the implementation of water conservation strategies. The main conclusions of this study are as follows:

- 1) Half of the respondents indicated that factors associated with (a) increasing water demand (inefficient water use and/or increasing population) and/or (b) increasing water delivery costs (treatment cost and/or cost to meet regulatory requirements) will significantly impact the ability of their systems to meet future demands. Less than one-third (28%) of the respondents believed that long-run changes in weather patterns (including regional climate change) would seriously affect their systems' water supplies.
- 2) According to survey respondents, to meet future water demand, more than half of the water utilities plan to utilize supply-side management strategies, such as replacing or improving water supply infrastructures (56.3%), and securing new water supplies from traditional sources (50.3%). Slightly fewer respondents indicated that their systems plan on using demand-side management strategies to increase water or sewer rates (45.0%), or use non-price programs (39.7%). Furthermore, 39.7 percent plan to secure new water supplies from alternative sources.
- 3) More than one-third of water systems reported a decrease in their total and/or per capita water delivery over the last five years, implying increased efficiency of water use and water conservation by the systems' customers.
- 4) The majority of respondents (57%) report that to encourage water conservation, their utility companies are currently using or have used in the past non-price conservation strategies.

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Mandatory watering restrictions and conservation education/awareness programs are the most widely used.

- 5) In literature, inclining block rate structures (i.e., rate structures with the unit rates increasing with water use level) are presented as "conservation-oriented" structures that are designed to provide incentives to the customers to conserve water. Eighty-five percent of the survey respondents reported that their utility companies employed inclining block rate structures. The other 15 percent of respondents reported using uniform rate structures (with unit charges independent of the water use levels).
- 6) Inclining block rate structures varied significantly among utilities. The number of blocks ranged from 2 to 21, with the mean of 4.2. On average, the rate for the first thousand gallons was \$1.44 (with the range of \$0 – \$8.67). The average rate for the 50th thousand gallons was significantly higher – \$5.19 (with the range from \$0.38 to \$45.24). In addition, utilities charged, on average, \$12.05 as fixed monthly fee (i.e., the fee that is charged every month independently from the water use level). The fixed monthly fees varied among the utilities from \$3 to \$28.94. For comparison, among the utilities that used uniform rate structures, water rates ranged from \$0.69 to \$5.75 per thousand gallons, with a mean of \$2.44. In addition, fixed monthly fees ranged from \$5.79 to \$33.66, with an average of \$12.69.
- 7) Given the rate structures reported by the survey respondents, for a hypothetical household that used 7 thousand gallons of water per month, an average monthly bill would be similar given a uniform or an inclining block rate structure. Hence, for such a household, inclining block rate structures do not necessarily imply stronger economic incentives to conserve water.
- 8) In contrast, for a household that uses 40 thousand gallons per month, the average monthly bill would be significantly higher given inclining block rate structures, compared with uniform rate structures reported by survey respondents. When averaged among all the utilities that responded to the survey, an average monthly bill would be \$208 given an inclining rate structure, and only \$96 given a uniform rate structure. Hence, for large residential water users, the implementation of inclining block rate structures creates stronger economic incentives for water conservation, than uniform rates.
- 9) Barriers to the use of price-based and non-price conservation strategies identified in this study include:
 - *Limited staff and revenue requirements* faced by water utilities.
 - *Perceptions and knowledge about the effectiveness of conservation pricing* among water utilities' representatives. Although utility representatives perceive water rates as an important demand management tool, one-third (33%) of survey respondents indicated that their utilities did not estimate changes in water use in response to change in rates. When asked to estimate the effect of a rate change, 72 percent of respondents perceived that a 10 percent increase in price will have limited to no effect on water use.
 - *Lack of customer awareness of water rates.* Only 45 percent of respondents reported that their utilities display water rate information on their water bills. Lack of access to water rate information may be a factor influencing customers' ability to respond to the conservation price signal.
- 10) In promoting water conservation, Florida state and regional agencies should take into consideration the special challenges faced by water utilities owned by municipalities, counties, or the state. In this study, respondents from such utilities were more likely to report that revenue requirements are a barrier for their utilities to implement price- and non-price conservation programs, compared to the utilities of other ownership types. Furthermore, such utilities more frequently considered the subsidies for non-water utility operations in their water rate decision.

Introduction

In this publication, we examine the relative use of conservation strategies by Florida water utilities. Water conservation is "the most important action we can take to sustain our water supplies, meet future needs, and reduce demands on Florida's fragile water-dependent ecosystems such as lakes, streams, and the Everglades" (FDEP 2008). Conservation strategies include irrigation restrictions, conservation water rates, incentives for water reuse, education and outreach programs, irrigation design and installation standards, and cost-share incentives (e.g., rebates) (FDEP 2002). Implementation of water conservation strategies is impossible without broad support from water providers (i.e., water utilities). This publication aims at examining water utilities' perspectives on various water conservation strategies. Which strategies are perceived by water utility representatives as being the most efficient? What challenges do water utilities face in implementing these strategies? What is the role of water conservation efforts in meeting future residential water demands? These are some of the questions that we try to answer in this publication.

Method

This publication summarizes a 2009–2010 survey of representatives of Florida's drinking water systems. We identify 742 community water systems in Florida that serve at least 501 people (referred to as "water utilities" in this publication) (FDEP 2009). The associated service areas of these utilities include counties, municipalities, cities, mobile home parks, subdivisions, and/or apartments (FDEP 2007).

The survey questionnaire was designed by a team of researchers from the land-grant universities in Florida, Oklahoma, Tennessee, and Arkansas participating in the Water Economics and Policy Team, Southern Regional Water Program of the United States Department of Agriculture (USDA). The questionnaire was pre-tested with 20 representatives of Florida utilities and revised based on their comments. Next, we surveyed 722 utilities that did not participate in the survey pre-test. A mixed-mode survey method was used; i.e., responses were collected for both online and postal mail hard-copy versions of the survey. For the online version, 584 phone contacts were identified for 722 utilities (FDEP 2009). Graduate students from University of Florida and Oklahoma State University called each of these contacts up to four times and asked about representatives of the utilities who could participate in the survey. Representatives of 317 utilities agreed to take the survey, and 130 of them provided their responses in August–September 2009 (18% of 722 systems in the sample). Next, in January–February 2010, hard copies of the survey were sent by mail to those systems that were not contacted about or that did not respond to the online survey. Sixty-seven completed responses to the survey by mail were received (9.3% of 722 water systems in the sample).

The overall response rate to the survey was 27.3 percent (197 completed surveys). While this is not a large sample, it represents the first systematic examination of the views of water system representatives in Florida. Response rate varies from question to question, and the number of responses received for individual survey questions, N , is reported below.

The survey did not target utility representatives that held specific positions within water systems. Instead, we focused on reaching the contact people identified by FDEP (2009). As a result, we expected a mix of utility or city / municipality employees to respond to the survey. Different representatives may have access to different types of information about utility operations. And hence, responses to some survey questions may reflect only the opinions of the specific utility employees responding to the survey, and may not coincide with the opinions of their colleagues in the same utility company. However, we expect that all representatives should be sufficiently informed about the main characteristics of their utilities (such as utility size, supply expansion plans, or water

Characteristics of Community Water Systems in Florida as Represented by Survey Respondents

Three-quarters of the responses (74.6%) were received from the utilities located in the jurisdictions of the three largest water management districts: South Florida (SFWMD), St. Johns River (SJRWMD), and Southwest Florida (SWFWMD) (Table 1). In comparison with the original sample of 722 water systems, there were fewer respondents from SFWMD, and more respondents from the Northwest Florida Water Management District (NFWMD). Furthermore, survey respondents represented the utilities that were more likely to be large or very large, and reliant on surface water or a mix of surface and ground water, compared to the original sample of 722 water utilities (Table 1). To examine if such differences were important, we examined the variation in survey responses among utilities of different sizes, ownership types, water sources, and water management district jurisdictions. Statistical procedures, referred to as "chi-square test" and "analysis of variance" (ANOVA), were used. (For more information about statistical analysis of survey response data, see Israel [2009].)

Table 1. Water utilities' characteristics*

Description	Sample of 722 Florida Water Utilities (%)	Utilities Participated in the Survey (%)
<i>What water management district(s) is your utility in? (circle all that apply)</i>		
Northwest Florida	13.9	18.5
South Florida	33.6	24.3
Southwest Florida	23.6	24.9
St. Johns River	23.7	25.4
Suwannee River	5.3	6.9
Total	100	100 (N=189)
<i>How is your utility's ownership structured? (circle one answer)</i>		
Municipal, county, or state-owned	56	76.2
Private investor owned	38	7.6
Other – private (subdivision, water association)	4	2.1
Customer-owned nonprofit or cooperative	1	10.8
Other / unknown	1	3.2
Total	100	100 (N=185)
<i>Please, indicate the approximate population size served by your system (select one)</i>		
Very small	0	1.12
Small	49.5	22.6
Medium	19.0	23.1
Large	26.3	36.0
Very large	5.3	17.2
Total	100	100 (N=186)
<i>In a typical year, what are primary and secondary sources of water for your utility? (circle all that apply)</i>		
Ground Water Only	93.23	85.1
Surface Water Only	0.1	6.4
Combination of surface and ground water	6.6	8.5
Total	100	100 (N=188)

* Information for the original sample of 722 water utilities is based on FDEP (2009). Utilities that participated in the survey were characterized based on the survey responses.

Factors That Influence Utilities' Water Delivery

More than one-third of water systems reported a decrease in their total and/or per capita water delivery over the last five years, implying increased efficiency of water use and water conservation by the systems' customers (Figure 1).

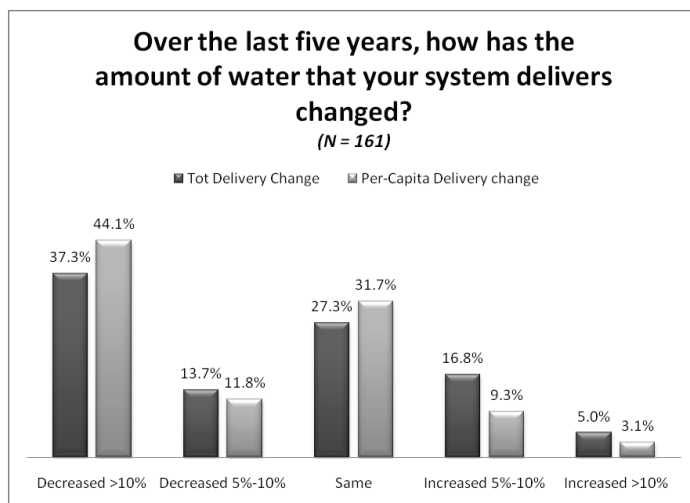
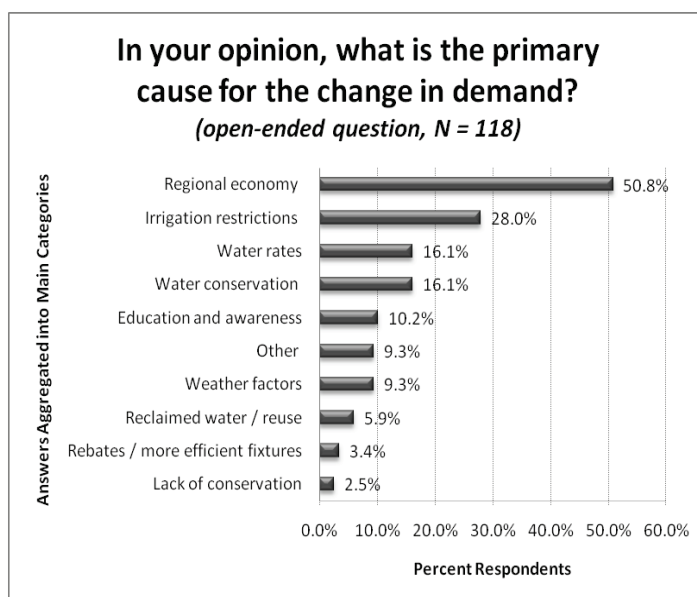


Figure 1. Changes in water delivery in the last five years (percent of respondents)

Figure 2. Primary causes for change in water demand (% respondents)



When asked about the primary drivers for the water delivery change, more than half of the survey respondents (50.8%) described changes in regional economic activity (Figure 2). Specifically, many systems reported economic growth, commercial development, and population growth in the last five years as the primary causes for water delivery increase. Others blamed the reduction in regional economic activity, population decreases, loss of major industries, and housing foreclosures for the reductions in water demanded and delivered. Demand management and conservation were also

significant factors in water use changes. The second most frequently mentioned cause of water delivery reductions was irrigation restrictions (28% of respondents). Sixteen percent of respondents mentioned changes in water rates to encourage water conservation, and 10 percent referred to education and awareness programs.

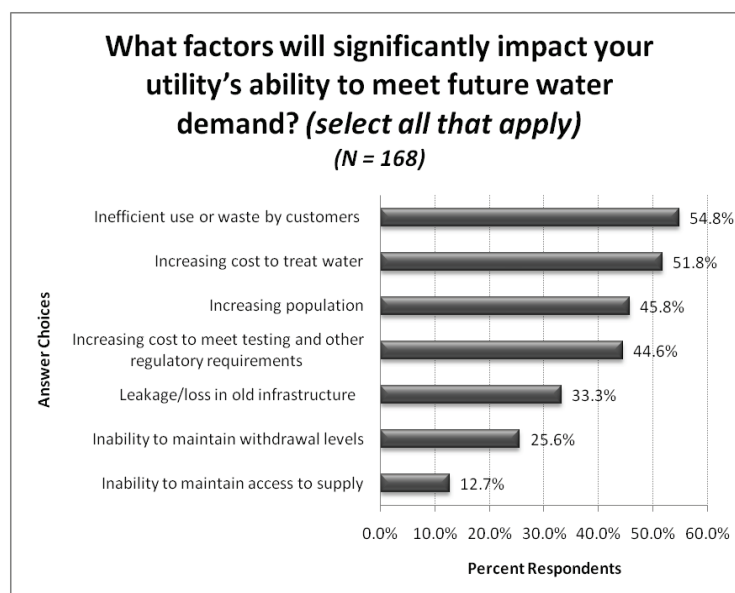


Figure 3. Factors that will significantly affect utility's ability to meet future water demands

When asked about projected future water delivery, about half of the respondents indicated that factors associated with (a) increasing water demand (inefficient water use and/or increasing population) and (b) increasing cost of water delivery (treatment cost and/or cost to meet regulatory requirements) will significantly impact their system's ability to meet future demands (Figure 3). Fewer respondents were concerned with water resources, specifically with the ability to maintain withdrawal levels (25.6%) and/or the ability to maintain access to supply (12.7%).

The number of respondents that were concerned about the inability to maintain withdrawal levels was higher among systems that utilized ground-water sources (29.5%, compared to 8.3% responses from the utilities utilizing surface water or a combination of surface and ground water) (chi-square test indicated that this difference is statistically significant at 95% confidence level). Such difference may be caused by the concerns about reductions in ground-water (aquifer) levels (see, e.g., Hornsby 2003). Since the percentage of utilities that use ground-water sources was lower among the survey respondents compared to the total sample of 722 utilities, the survey results may underestimate the overall concern of water utilities about future withdrawal levels.

Furthermore, respondents from the utilities in NFWFMD were less concerned with leakage and loss of old infrastructure—only 16 percent of respondents selected this answer choice, in comparison with 39 percent of respondents from all other water management districts combined (chi-square test indicated that this difference is statistically significant at 95% confidence level). Further study is needed to explain this difference in responses. Since the percentage of utilities from NFWFMD was higher among the survey respondents compared to the total sample of 722 utilities, the survey results may underestimate the overall concern of water utilities about leakage and loss of old infrastructure.

No other systematic differences among utilities of different sizes, ownership types, or utilities utilizing alternative water sources, were found (chi-square test, 95% significance level).

Belief about the Potential Impacts of Climate Change

Respondents from more than one-quarter (28%) of the water systems believed that long-run changes in weather patterns (including regional climate change) would seriously affect their systems' water supply (Figure 4). Forty-two percent of the respondents were "not sure", indicating lack of information on the topic and an education opportunity. Thus, the current mix of views regarding climate change by the general citizenry is reflected in perceptions of the utilities' representatives.

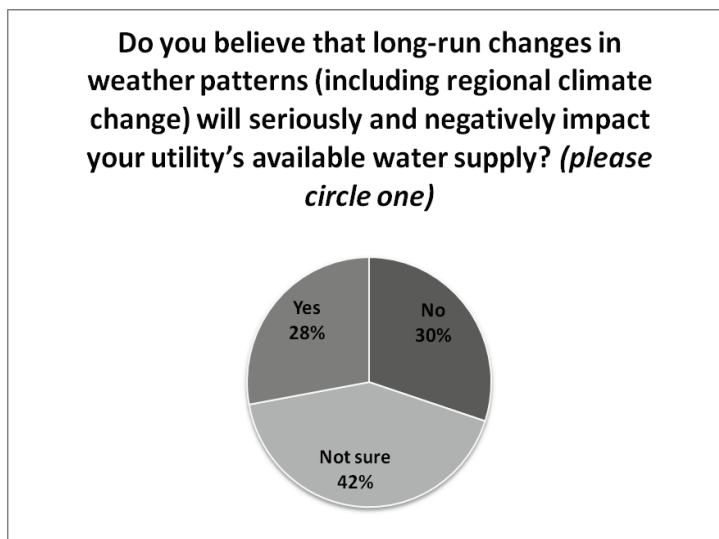


Figure 4. Opinions about the impacts of long-run weather changes on water systems' supply

Interestingly, when the responses were compared across water management district jurisdictions, the percent of respondents who believed that the long-run weather / climate changes can seriously and negatively impact water supply was higher in NFWMD (47%, in comparison with 27% of respondents from all other water management districts combined; chi-square test at 95% confidence level). Again, further study is needed to explain this difference in responses. Since the percentage of utilities from NFWMD was higher among the survey respondents compared to the total sample of 722 utilities, the survey results may overestimate the overall concern of water utilities about future impacts of climate change on water supply.

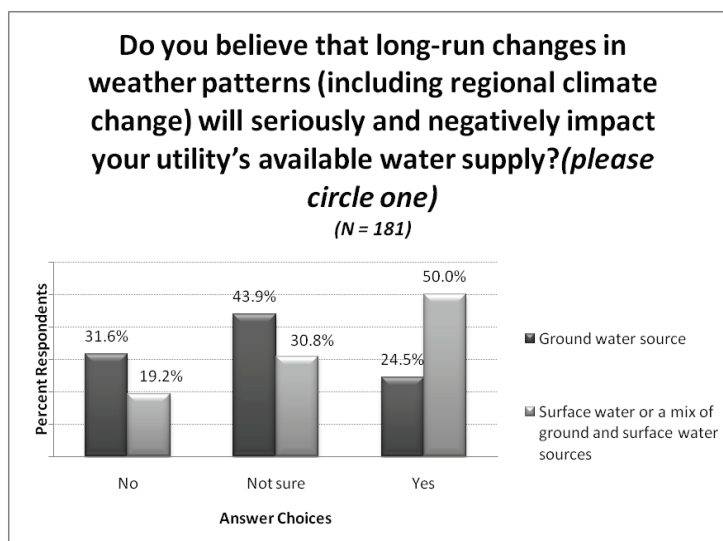


Figure 5. Opinions about the impacts of long-run weather changes on water utilities' supply (by utilities' water sources)

Responses also depended on the source of water used by respondents' water utilities: the number of respondents who were *not* concerned about climate change impacts was higher among the systems utilizing ground-water sources (31.6%, compared to 19.2% among the systems using a mix of sources or surface water only; Figure 5) (chi-square test, 95% confidence level). This result is surprising because utilities utilizing ground water can be especially vulnerable to one potential consequence of climate change—salt water intrusion (i.e., intrusion of saline water into freshwater aquifer). Since the percentage of utilities utilizing ground water was lower among the survey respondents compared to the total sample of 722 utilities, the survey results may overestimate the overall concern of water utilities about future impacts of climate change on water supply. No other systematic differences among utilities of different sizes, or ownership types were found (chi-square test, 95% significance level).

Use of Conservation, Demand Management, and Supply Management Strategies

According to survey respondents, to meet future water demand, more than half of the water utilities plan to utilize supply-side management strategies, such as replacing or improving water supply infrastructure (56.3%), and securing new water supply from traditional sources (50.3%; Figure 6). Slightly fewer respondents indicated that their systems plan on using demand-side management strategies to increase water or sewer rates (45.0%), or use non-price programs (39.7%). Furthermore, 39.7 percent plan to secure new water supply from alternative sources.

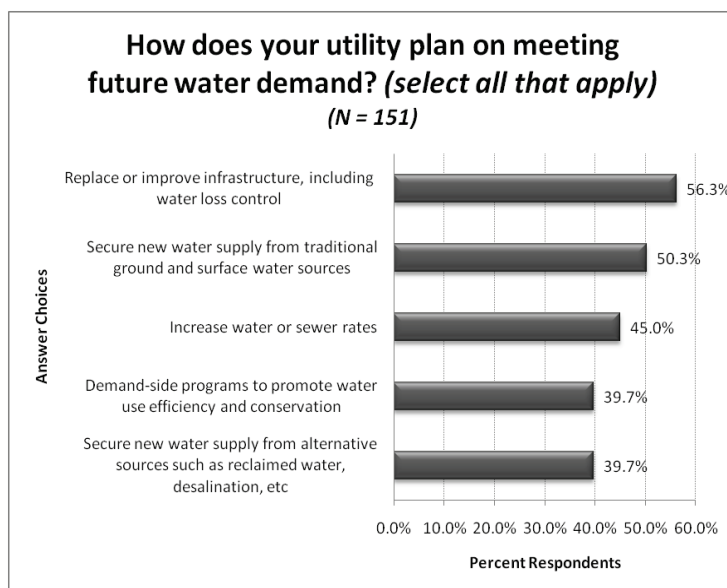


Figure 6. Plans to meet future water demands for Florida water systems

The responses depended on the utilities' water management district jurisdictions. While only 24 percent of respondents from the utilities in SFWMD indicated that their utilities are planning on increasing water and sewer rates, 59 percent of systems in NFWMD and 58 percent in SJRWMD were planning on doing that. For comparison, 44 percent of respondents from SWFWMD and 33 percent of respondents from SRWMD (Suwannee River Water Management District) indicated that their systems plan on increasing water or sewer rates to meet future water demand. It may be the case that utilities in the water management districts of southwest and south Florida have already implemented conservation-oriented water rates, while water systems in the other districts are still planning to utilize this strategy to curb water demand. No other systematic differences among utilities of different sizes, ownership types, or sources of water were found (chi-square test, 95% significance level).

Florida Water Utilities

- 85% of systems employed inclining block rate structures, and the remaining 15 percent had uniform rate structures
- 94 percent of very large and 92 percent of large systems implemented inclining block rate structures
- Fewer medium and small systems implemented inclining block rate structures (74% and 77% respectively), compared with large and very large systems

Water rates

Respondents were asked to provide their utilities' water rate information for residential, in-city water uses. One hundred and eighty water systems (24.9% of the 722 water systems in the original sample) did so. Water rates included fixed monthly fees that were charged independently from the water use volumes, and volumetric rates that were based on actual monthly water uses (set in dollars per thousand gallons). Fixed monthly fees ranged from \$3.00 to \$33.66 per month, with a mean of \$12.15 per month. No systematic differences among utilities using different water sources or utilities of different ownership types, sizes, or water management district jurisdictions were found (chi-square test, 95% significance level).

In turn, two types of volumetric rate structures were used by the utilities: (1) uniform (when a single per-gallon water rate is charged for any volume of water used), and (2) inclining block (when per-gallon rate increases with the amount of water used). Eighty-five percent of systems employed inclining block rate structures, and the remaining 15 percent had uniform rate structures. While 94 percent of very large and 92 percent of large systems implemented inclining block rate structures, these percentages were significantly lower among small and medium systems (77% and 74%, respectively) (chi-square test, 95% significance level). Since inclining block rates are usually more difficult to administer, such difference in responses may indicate that larger utilities have more resources available to them to implement inclining block rate structures. Since the percentage of large and very large utilities was higher among the survey respondents compared to the total sample of 722 utilities, the survey results may overestimate the overall use of inclining block rate structures by Florida utilities. No other systematic differences among utilities using different water sources or systems of different ownership types or water management district jurisdictions were found (chi-square test, 95% significance level).

Among the utilities that employ inclining block rate structures, the number of price blocks ranged from 2 to 21, with a mean of 4.2. One-third of the systems (33.3%) used the inclining block rate structures with 4 blocks, and only 14.4 percent of systems have rate structures with 6 or more blocks. Unit rates ranged from \$0 per thousand gallons for the first price block (i.e., customers paid only a fixed base monthly fee) to \$45.24 per thousand gallons for the water use above 20,000 gallons per month. In turn, for the utilities that employed uniform rates, unit rates range from \$0.69 to \$5.75 per thousand gallons, with a mean of \$2.44 per thousand gallons.

We also compared the water bills that an average Florida household would pay given different water rates used by the utilities. An average household in Florida uses 95 gallons of water per day (Marella 2005), and includes 2.46 people (U.S. Census Bureau 2000). That is, average household water use is about 7.1 thousand gallons per month. Given fixed and volumetric rates reported by the survey respondents, water bills for such water use levels would range from \$7.17 to \$58.82 per month (with a mean of \$27.53). While small systems would charge on average \$31.85 for this water use level, the water bill from large systems would be only \$25.01 (on average). This difference was statistically significant (ANOVA, 95% confidence level), and it may be explained by the difference in the costs of water delivery among utilities of different sizes. No other statistically significant difference was found among the bills from different types of utilities and volumetric rate structures (ANOVA test, 95% confidence level).

Water rate is defined as a "conservation-oriented" if it creates an economic stimulus to conserve water. Usually the "strength" of a conservation price signal is measured by the levels of average and marginal water rates. Average rate can be found by dividing the water bill by the water use level, while the marginal rate is just the rate that should be paid to increase water use by an extra unit. For the monthly water use of 7.1 thousand gallons, average rates ranged from \$1.01 to \$8.28 per thousand gallons (with a mean of \$3.88). In turn, marginal rates ranged from \$0 to \$6.08 per thousand gallons (with the mean of \$2.74). Hence, the economic incentives for water conservation provided by Florida utilities varied significantly. Interestingly, neither average nor marginal rates depended (in statistically significant way) on the type of the volumetric rate structure (i.e., uniform versus inclining block). This implies that implementation of inclining-block rate structures does not necessarily lead to greater incentives to conserve water.

Factors That Influence Utilities' Water Rate Decisions

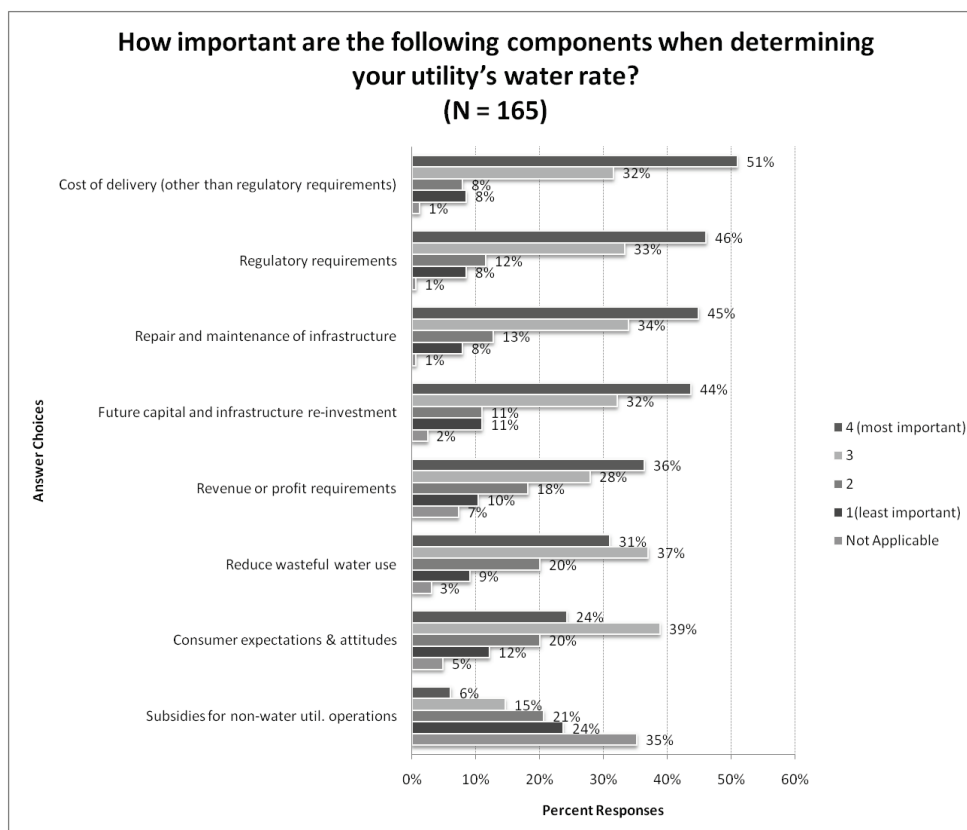


Figure 7. Determinants of water rates

Survey respondents were asked to evaluate the importance of different factors in their utilities' water rate decisions (1=lowest importance to 4=highest importance). Cost of delivery was considered highly important (with the ranking of "4" or "3") for 84 percent of respondents (Figure 7). Repair and maintenance of infrastructure, future capital and infrastructure re-investments, and regulatory requirements were also important to about 80 percent of respondents (ranking of "4" or "3"). Reducing wasteful water use and customer expectations and attitudes were important (ranking of "4" or "3") by about two-thirds of respondents (38%).

The importance of individual components in utilities' water rate decisions depended on the water management district jurisdictions and on utilities' ownership types. Specifically, more respondents from SJRWMD indicated that cost of delivery is *not important* to them (ranking of "1" or "2") (28% in comparison with 13% of systems from all other WMDs combined) (chi-square test, 95% confidence level). Furthermore, subsidies for non-water utility operations were not relevant to 50 percent of utilities that were not municipally-, county-, or state- owned systems (and only 30% of municipally-owned utilities). In contrast, such subsidies were important (ranking of "4" or "3") to 24 percent of municipally-owned systems (in comparison to 8% of systems of other ownership types) (chi-square, 95% confidence level). Since the percentage of municipal-, county-, or state-owned utilities was higher among the survey respondents compared to the total sample of 722 utilities, the survey results may overestimate the importance of subsidies to non-utility operations. No other systematic differences among utilities of different sizes, water management district jurisdictions, or ownership types were found (chi-square test, 95% significance level).

Changes in Water Rates and Their Effects on Water Use

According to survey responses, in the last five years, 52 percent of the systems changed their water rate structure, and 60 percent changed their average rates (Table 2). It is somewhat surprising to find that only 60 percent of the systems have changed their rates in five years. With concern for different issues identified by respondents, many managers seem unable to address the problem of financial and environmental sustainability through revenue-enhancing (and demand-reducing) strategies. The politics of raising prices may be one reason for nominal price stability (which means declining real prices of water for these systems). Furthermore, one-third of respondents (33%) reported that their water systems have not estimated the impact of water rate changes on water use.

Table 2. Changes in water rates

Description	Percent Respondents
<i>Has your utility changed its water rate structure in the last five years? (N=181)</i>	
No	48.1
Yes	51.9
<i>Have your utility's AVERAGE rates changed in the last five years? (N = 184)</i>	
No	40.2
Yes	59.8
<i>Has your utility estimated how a change in water rates will impact water use? (N=183)</i>	
No	32.8
Yes	29.5
Not Sure	37.7

Respondents from SFWMD reported changes in average rate more often (75% versus 56% of respondents from all other water management districts combined; chi-square test at 95% confidence level). Also, while only 49 percent of respondents from small systems reported changes in average rates, this percent was much higher among respondents from very large systems (84%). The number of similar responses from medium and large systems was 58 percent and 59 percent, respectively. Chi-square test indicated that difference was statistically significant at 95 percent confidence level. Smaller utilities may have smaller staff and, hence, it may be more difficult for such systems to re-evaluate and revise their water rates. Since the percentage of large and very large utilities was higher among the survey respondents compared to the total sample of 722 utilities, the survey results may overestimate the overall number of utilities that changed their rates in the last five years.

We also asked about perceptions of price elasticity of water demand (i.e., the percent change in water use for a given percent change in water prices). Forty percent of respondents believe that prices have no impact on quantity demanded—which is counter to overwhelming empirical evidence (Table 3). Fifty-one percent of respondents believe that a 10 percent change in water rates have a very small effect on water use (more than 0 but less than 5%). Only 4 percent of respondents believe that a 10 percent change in water rates can reduce water use by 10 percent or more. Nationally, studies have found that a 10 percent increase in water rates will result in about a 3 percent drop in water use (Rawls and Borisova 2009).

Table 3. Elasticity of water demand (N = 162)

Percentage Change in Water Demand for a 10% Increase in Water Price As Perceived by Respondents	Percent Respondents
Increase	4.3
No Change	40.1
Decrease less than 5%	32.1
Decrease 5–10%	19.1
Decrease 10–15%	3.7
Decrease more than 20%	0.6

To effectively influence customers' behavior, water rate information should be readily available. However, less than half of respondents (45%) indicated that water rate information can be found on the households' water bills (Figure 8). Perhaps this lack of information is unsurprising given managerial perceptions regarding ineffectiveness of price as a determinant of quantity demanded.

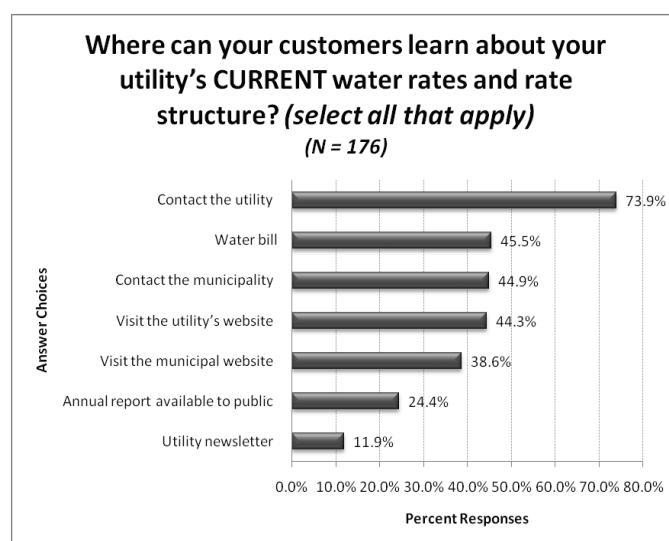


Figure 8. Ways to notify customers about water rates

To summarize, although a majority of water systems in Florida use inclining block rates that are designed to send a price signal to the customers to conserve water, the effect of water rates on household water-use behavior is perceived to be rather small. Water systems still largely see water rates as a cost-recovery instrument. From the standpoint of public policy, to influence water demand, water rate information must be readily accessible and understood by the customers; however, many Florida water systems do not report water rate information on the water bills. This lack of public information may be dampening the conservation effects of water pricing.

Use of Non-Price Conservation Programs

Fifty-seven percent of respondents indicated that their systems either use currently or have used non-price conservation programs (Figure 9). This percent was higher among the respondents from municipally-, county-, or state-owned systems (65.2%) compared to respondents from utilities of all other ownership forms combined (26.8%) (chi-square test, 99% confidence level). The response also differed by water management district jurisdictions (chi-square test; 99% confidence level). The highest percent of respondents indicated that their systems use non-price conservation strategies in SJRWMD (70.5%) and SFWMD (68.2%). The lowest percent was in SRWMD (25.0%) and NFWMD (29.0%). For the SWFWMD, 58 percent of respondents indicated that their systems use (or have used) non-price conservation strategies. The water management districts of Florida can influence water utilities' decisions to implement non-price conservation strategies by changing the requirements for consumptive-use permits (i.e., permits that allow water utilities to pump water from ground or surface water sources). The difference in rules and policies among water management districts may influence the variation in survey responses. Furthermore, water management districts can impose watering restrictions that prohibit lawn and landscape watering for specific days of the week. Local governments (many of which also manage water systems) are increasingly encouraged to incorporate this non-price conservation strategy in local ordinances and to enforce the ordinances accordingly, which in turn points to why the percent of systems implementing non-price conservation strategies may be higher among municipality-, county-, or state-owned utilities.

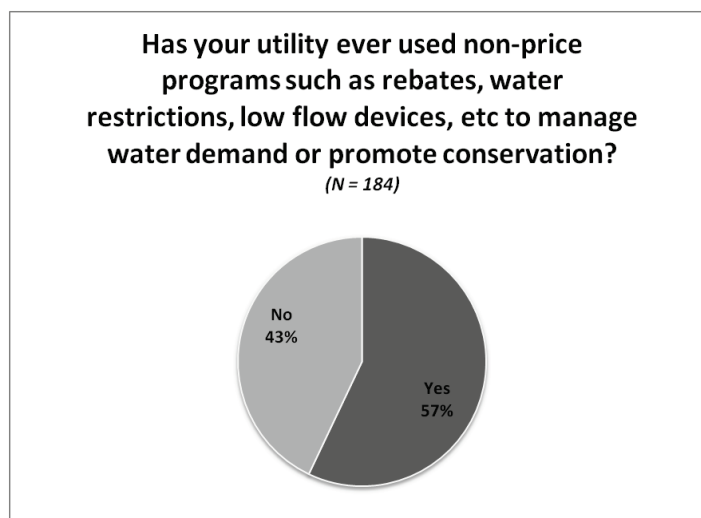


Figure 9. Use of non-price water conservation programs (percent respondents)

Percent of responses about the use of non-price strategies also increased with the size of respondents' utilities. For example, only 21.6 percent of respondents from small utilities reported using non-price

strategies as opposed to 81.3 percent from very large utilities (chi-square test; 99% confidence level). As non-price conservation strategies may affect utilities' revenues, smaller systems (that generally have higher costs of water delivery) may be more reluctant to implement them. Since the percentage of large and very large utilities was higher among the survey respondents compared to the total sample of 722 utilities, the survey results may overestimate the overall use of non-price conservation strategies by Florida utilities. No statistically significant differences among systems using different water sources were found.

Among the respondents who indicated that their utilities are using / have used non-price conservation strategies, the majority point to mandatory watering restrictions and education and awareness programs (Figure 10). Survey respondents were also asked to describe the most cost-effective conservation program (i.e., the program that they perceived as having saved the most water per dollar invested). Although the response rate to this question was relatively low (61 systems, or 8.6% of the sample of 722 utilities), one-third of the respondents (30%) ranked irrigation restrictions as the most cost-effective strategy. Other strategies (such as rebates and installations of low-flow devices, and education and awareness campaigns) were mentioned by fewer respondents.

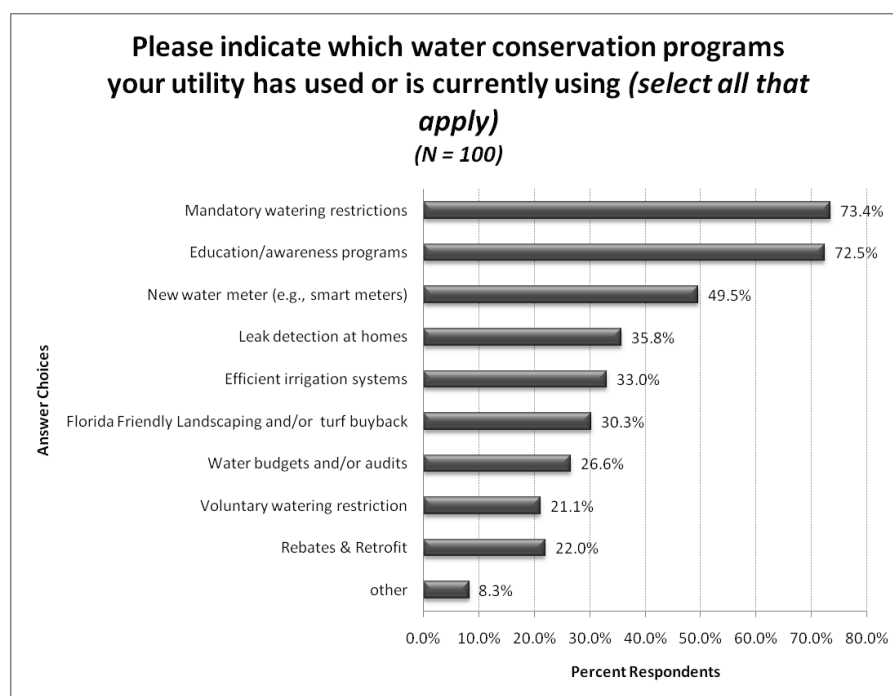


Figure 10. Conservation programs used by Florida water systems

Barriers to Implementation of Conservation Pricing and Non-Price Conservation Programs

When asked about the primary barriers to implementing conservation pricing and non-price conservation programs, almost half of respondents (45%) cited limited staff, and 42 percent indicated that they do not currently face water shortage (Figure 11). Revenue requirements were mentioned by 38 percent of respondents. This suggests a large percentage of systems have a need for conservation programs and pricing, but do not adopt them due to resource constraints.

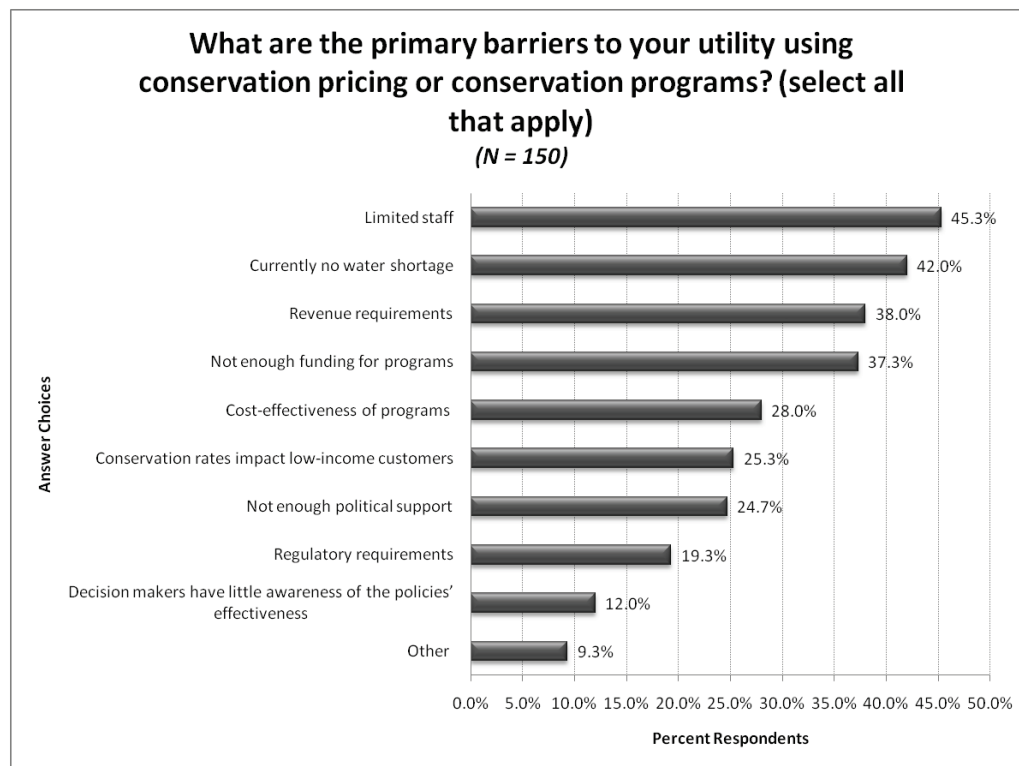


Figure 11. Barriers to successful conservation pricing or conservation programs

Revenue requirement was reported as a barrier for water conservation by 45 percent of respondents from municipally-, county-, or state-owned utilities, compared to 20 percent of respondents from utilities of all other ownership types (chi-square test, 99% confidence level). Since the percentage of municipally-, county-, or state-owned utilities was higher among the survey respondents compared to the total sample of 722 utilities, the survey results may overestimate the importance of revenue requirements as a barrier for water conservation.

While 75 percent of respondents from NFWFMD indicated that their systems currently do not face water shortages, only 26 percent of respondents from SWFWMD, and 31 percent of respondents from SFWMD thought so. For comparison, 50 percent of respondents from SRWMD, and 44 percent of respondents from SJRWMD believed that their systems did not face water shortages (chi-square test, 99% confidence level). Utilities in south and southwest Florida have been facing the challenges of meeting rapidly increasing water demands (resulting from population growth), decline in ground-water (aquifer) levels, and saltwater intrusion in coastal aquifers. By contrast, in northwest Florida and the Suwannee River basin, the rate of population growth has been significantly smaller, and the annual average rainfall level is generally higher (Fernald and Purdum 1998). These factors may explain the difference in survey responses.

Furthermore, while 62 percent of representatives of small utilities indicated that their utilities currently did not face water shortages, only 31 percent of large and 33 percent of very large systems thought so. For comparison, 43 percent of representatives of medium systems thought that their utilities did not face water shortages (chi-square test, 95% confidence level). Water withdrawals increase with the size of utility and, hence, larger utilities may be more vulnerable to changes in ground-water (aquifer) levels. Since the percentage of large and very large utilities was higher among the survey respondents compared to the total sample of 722 utilities, the survey results may underestimate the importance of the lack of water shortages as a barrier for water conservation.

Conclusion

This publication examines the use of and barriers to water conservation strategies for Florida water utilities. We found that to encourage water conservation, most Florida utilities use non-price conservation strategies (57% are currently using such strategies or used them in the past). Among non-price conservation strategies, mandatory watering restrictions and conservation education/awareness programs are used most widely. To create incentives for water conservation, 85 percent of respondents employed inclining block rate structures with the unit rates increasing with customers' water use.

We identified several barriers to the use of price-based and non-price conservation strategies:

- ❖ *Limited staff and revenue requirements* were among the most frequently mentioned barriers, which should be considered by any state or regional program that encourages broader use of conservation strategies.
- ❖ *Perceptions and knowledge about the effectiveness of conservation pricing* may also be a barrier to adoption. Although utility representatives perceive water rates as an important demand management tool, one-third (33%) of survey respondents indicated that their utilities did not estimate changes in water use in response to change in rates. When asked to estimate the effect of a rate change, 72 percent of respondents perceived that a 10 percent increase in price will have limited to no effect on water use.
- ❖ *Lack of customer awareness of water rates*, too, can be identified as a barrier to conservation strategies in that only 45 percent of respondents reported that their utilities display water rate information on their water bills. Lack of access to water rate information may be a factor, then, in influencing customers' ability to respond to the conservation price signal.

Implementation of water conservation strategies have been encouraged by Florida state agencies and water management districts. However, the agencies should account for the special challenges and concerns of water utilities of owned by municipalities, counties, or state-run. Specifically, respondents from municipally-, county-, or state- owned utilities were also more likely to report that revenue requirements are a barrier for their utilities to implement price- and non-price conservation programs. Municipally-, county-, or state- owned systems also more frequently considered the subsidies for non-water utility operations in water rate decision.

We also found that an average household using 7.1 thousand gallons per month faces the same incentives to conserve water (measured as marginal and average water rates) whether given uniform or inclining block rate structures. Hence, implementation of inclining block rate structures did not necessarily imply stronger economic incentives for water conservation.

This study employed a survey method to evaluate perception and use of water conservation and demand management strategies by Florida water systems, and while survey methods are widely used in social science research, there are disadvantages, including: (a) the accuracy of survey responses depends on respondents' memory and honesty; (b) people who responded to the survey may be different from those who did not respond, biasing the results; and (c) interpretation of survey questions and answer-choices presented may differ among respondents. Therefore, to examine if the difference between the utilities that participated in the survey and the total sample of 722 utilities may bias the survey results, we examined the variation of survey responses among utilities of different sizes, ownership types, water source, and location.

Respondents from municipally-, county-, or state- owned utilities were found to be more likely to report the use of non-price conservation strategies, while the revenue requirements were more likely to be a barrier for their utilities. Municipally-, county-, or state- owned systems also more frequently considered the subsidies for non-water utility operations in water rate decision. Overall, the survey responses may need to be adjusted to reflect the difference between the percentages of municipally-, county-, or state-owned utilities among the survey respondents compared to the total sample of 722 utilities.

Survey respondents varied depending on the geographic location of the respondents' utilities, which reflected different climate and population characteristics of various parts of the state, and different regulations implemented by Water Management Districts. Specifically, in northwest Florida, population growth has been relatively slow, and periodic drought may be less pronounced. As a result, a large majority of respondents from NFWFMD thought that their systems do not currently face water shortages, and that their utilities are not currently using / have not used in the past non-price conservation strategies. However, respondents from NFWFMD were more likely to be concerned about the potential impacts of climate change on their utilities' available water supply, and they more frequently reported about their utilities' plans to increase water and sewer rates to meet future water demands (compared to respondents from other parts of Florida). Hence, although northwest Florida has been largely unaffected by water shortages, water utilities are concerned about the future of water supply, and are planning on a wider use of water conservation tools.

In contrast, another part of Florida—South Florida—experienced significant increase in population in recent years, which put additional pressure on water resources. As a result, respondents from SFWMD were less likely to indicate that their systems do not face water shortages, and they were more likely to state that their utilities changed average water rates in the last five years and are currently using / have used in the past non-price conservation strategies (compared to respondents from other areas of Florida). Overall, the survey responses may have to be adjusted to reflect the difference between the percentages of utilities from different water management districts among the survey respondents compared to the total sample of 722 utilities.

Furthermore, size of the utilities (defined by the population served) also influenced the decisions to implement conservation strategies. Respondents from small utilities were less likely to report the use of non-price conservation strategies and inclining block rate structures, compared to larger utilities. Small utilities usually face higher costs of water delivery, and they are more limited in staff. Hence, any reduction in revenues or increase in cost (that may be associated with conservation programs) would significantly impact small utilities operations. However, the fact that small utilities have higher costs of water delivery may have an unexpected consequence: for average household monthly water use of 7.1 thousand gallons per month, rates charged by small systems were higher than the rates of large systems. As a result, small utilities created stronger incentives for their customers to conserve water. Overall, the survey responses may need to be adjusted to reflect the difference between the percentages of utilities of different sizes among the survey respondents compared to the total sample of 722 utilities.

Survey responses also differed depending on the source of water utilized by respondents' utility companies. Specifically, the number of respondents that were concerned about the inability to maintain their companies' withdrawal levels was higher among utilities utilizing ground-water sources. Such a difference may be caused by the concerns about reductions in ground-water (aquifer) levels. Surprisingly, the number of respondents who were *not* concerned about climate change impacts was also higher among the systems utilizing ground-water sources. Overall, the survey responses may have

to be adjusted to reflect the difference between the percentages utilities that rely on ground-water sources among the survey respondents compared to the total sample of 722 utilities.

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