Final Report

May 13, 2003

SAWS Water Conservation Cost Savings

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Prepared for

Water Resources and Conservation Department
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Executive Summary and Conclusions

Water conservation achieved by the San Antonio Water System (SAWS) may lead to about $0.9 to $1.5 billion in cumulative cost savings over the next 50 years, in today's dollars. After subtracting the cost of ongoing conservation programs, the net savings to SAWS and its customers may be in the range of $0.7 to $1.3 billion, in 2003 dollars. These cost savings will slow the growth in average monthly bills and impact fees SAWS customers will pay in the future. SAWS has already seen cost savings from conservation in its current operations, as have other water utilities in fast-growing regions of the western United States.

Lowering the growth in water demand through conservation reduces the need for the most expensive of new water supplies. Lower growth in water use also means lower growth in wastewater flows, so SAWS will need fewer new wastewater treatment plants in the future. Because SAWS customers have reduced their water use, they will save money on future:

- Capital costs for developing new water supplies and building new water treatment plants;
- Operating costs for these new water supplies;
- Capital and operating costs for expanding the water transmission system; and
- Capital and operating costs for new wastewater treatment plants.

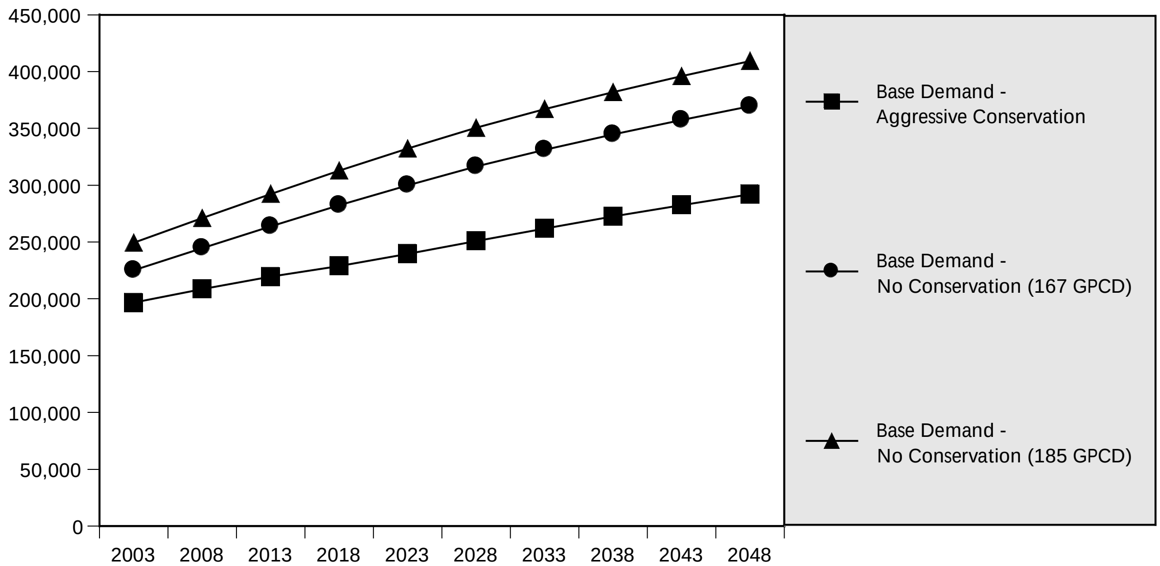
Background

BBC Research & Consulting (BBC) prepared this analysis at the request of SAWS. The SAWS Water Resources and Conservation Department provided BBC with three sets of project water demand projections for 2000 to 2050:

1. Water demand with aggressive conservation (the forecasts currently used by SAWS);
2. Water demand based on historic per-capita water use in the 1980s; and
3. Demand based on Texas Water Development Board projections that assumed no aggressive conservation.

BBC examined the cost savings to SAWS resulting from reducing future demands from the second and third set of projections to the water demand forecasts assuming aggressive conservation. In 2003, water demand would have been 14 percent higher under the second set of projections and 27 percent higher with the third set of projections. These savings increase over time to reach 26 to 40 percent by 2052. Exhibit ES-1 shows the projected demands across the next 50 years for each of the three scenarios.

Exhibit ES-1.
Base Demands (Acre-Feet) With and Without Conservation, 2003 through 2052



Source: SAWS Water Resources and Conservation Department, 2002.

BBC estimated future cost savings for future water supplies by comparing what it would cost to meet water demands under the two "without conservation" demand projections (the "low scenario" of 167 GPCD and the "high scenario" of 185 GPCD) to expected costs with aggressive conservation. We used a long-term economic optimization model of SAWS water resources to prepare these estimates.

BBC projected possible cost savings for other parts of SAWS' water delivery system and wastewater collection and treatment system by interviewing SAWS staff and analyzing recent financial reports on SAWS' capital and operating costs, including the 1996 rate study and the 2000 impact fee study.

Summary of Results

SAWS currently spends less than $6 million per year on its conservation programs. Assuming that current costs were an even $6 million and that annual costs grew with inflation and system population growth over 50 years, its cumulative present value would be about $210 million. In other words, SAWS would need $210 million today to fund the next 50 years of conservation programs.

If we assume that the current level of annual conservation program expenditures creates the range of conservation savings examined in this report, one can gauge whether the conservation program "pays for itself." Based on the assumptions and calculations used in this analysis, the answer is "yes" — the present value of conservation program costs ($210 million) is $660 million less than the present value of cost savings even under the low scenario ($870 million). Under the high scenario, the present value of cost savings is $1.46 billion, a difference of $1.25 billion from the present value cost of conservation. Exhibit ES-2 provides a table of these results.

Exhibit ES-2.
Present Value of SAWS Avoided Capital and Operating Costs and Net Cost Savings under Proposed Reductions in Water Demand, 2003-2052 (Millions)

	Low Scenario	*High Scenario*
New water supplies and new water treatment plant cost savings	$610	$1,040
Cost savings from water transmission and wastewater facilities	260	420
Total	*$870*	*$1,460*
Cost of conservation	*$210*	*$210*
Net savings	*$660*	*$1,250*

Note: All dollar amounts are 2003 dollars.
Source: BBC Research & Consulting and SAWS, 2003.

If a comprehensive conservation program in the $6 million per year cost range has this type of long-term impact, it is more than worth than the investment. SAWS would see, on average, cost savings of about $4 to $7 for every dollar invested in conservation.

Total customer water and wastewater revenue and impact fee requirements over the next 50 years are estimated to be reduced by $0.7 to $1.3 billion, on a present value basis, with the range of reductions in water demand examined in this study. Average monthly bills for SAWS customer will be lower than they would have been without a demand reduction.

Reductions in water sales due to conservation also reduce SAWS' revenues. Consequently, our findings do not mean that rates per 100 gallons of water use will decrease. The volume charge per 100 gallons may need to increase to offset lower water sales. Rather, the average total monthly water and wastewater bill and average impact fee are expected to be lower in the future if water demand continues to be reduced due to conservation.

SECTION I.
Introduction

Water utilities often pursue long-term water conservation efforts because "it is a good thing to do," or because state regulations require reductions in per capita water demand over time. Past BBC research has found that customers of water providers view water conservation to be among the most valued of a water utility's services.

However, does water conservation come at a price to the water provider? In the short-run, reductions in water sales resulting from conservation may result in rate increases for customers. Does this also mean that conservation does not "pay its own way?"

The San Antonio Water System asked BBC Research & Consulting to examine these issues. Because SAWS is shifting its focus from low-cost groundwater supplies to much more expensive out-of-basin supplies, any reductions in demand may substantially reduce future costs for developing, conveying and treating these supplies. We examine these potential cost savings from conservation in Section II of this report.

In addition, SAWS may save operating and capital costs for other parts of its water delivery system if the growth in average day and peak water demand is reduced through conservation. Lowering the growth in water demand also means reducing the growth of wastewater flows. SAWS may save money operating its wastewater collection and treatment system if total flows are lower than what they would have been without water conservation. SAWS could postpone or avoid certain wastewater treatment capital expenditures as well. Section III of the report analyzes potential cost savings for the water delivery and wastewater collection and treatment systems.

Section IV of the report compares the present value of future cost savings over the next 50 years with some assumptions about the cost of operating a conservation program over 50 years. This allows us to evaluate whether conservation is a good economic investment. We also assess in general how water demand reductions from conservation may impact the average monthly bill and average impact fee paid by SAWS' customers.

SECTION II.
Avoided Water Resource Costs

Conservation may reduce (avoid) certain water resource costs, including capital outlays for water resource development and the operations and maintenance costs for new resource projects that can be postponed or delayed by reducing customer demand growth. This section considers avoided costs up to the point where treated water enters the distribution system. This section also describes the methodology we used to calculate this portion of the cost savings and presents the results.

Background and Approach

Demand reductions created by conservation alters the mix of projects required, use of these projects and the associated costs, leading to cost savings.

BBC used Hydrosolve, the long-term water supply and economic model that we developed for the SAWS Water Resources and Conservation Department, to estimate the water resource cost savings attributable to conservation. The long-term water model determines the economically optimal mix of water resource projects to build and operate across a 50-year planning horizon given projected water demand and hydrologic conditions. Hydrologic conditions can be modified across different scenarios for simulation purposes. The model estimates capital and operating costs for all potable water delivered into the distribution system. Project options, cost and demand data were provided by the SAWS Water Resources and Conservation Department.

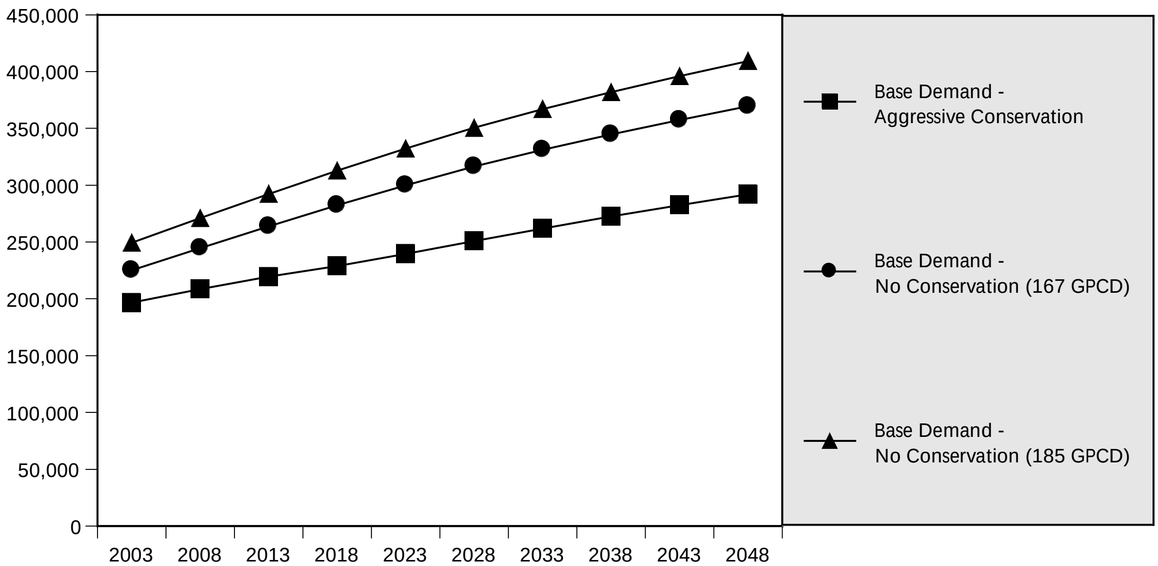
The simulation period spans the years 2003 through 2052. The impact of conservation on water resource costs can be viewed as the difference between total capital and operating costs to meet water demands under aggressive conservation compared with the costs to meet baseline demands without conservation.

Key assumptions. Several assumptions drive the results.

Demand. The Water Resources and Conservation Department provided BBC with three sets of projected demands for the years 2000 through 2050: one set with aggressive conservation, one based on SAWS' GPCD (gallons per capita per day) demands during the 1980s and one using the TWDB's "Below Normal Rainfall/Retrofit Only" demand estimates. The latter two estimates represent the Water Resources and Conservation Department's best estimate of the range of demands ("low scenario" and "high scenario," respectively) if no conservation program was in place. We extrapolated demands for the years 2051 and 2052.

Exhibit II-1 shows the base demands for potable water in both scenarios. Water reserve requirements, not shown on the graph, ranged between 10,000 acre-feet (AF) and 20,000 AF in the "with conservation" scenario and between 18,000 and 41,000 AF in the "without conservation" scenarios. BBC developed these water reserve requirements for each set of demand projections using SAWS' current policy of a 5-year reserve cushion through 2010 and a 10-year reserve cushion starting in 2011.

Exhibit II-1.
Base Demands (Acre-Feet) With and Without Conservation, 2003 through 2052



Source: SAWS Water Resources and Conservation Department, 2002.

Drought and critical periods. The present value of capital and operating costs depends upon projected customer demands and the water availability from each selected project. The long-term water model divides each year into two equal-length periods: summer and winter. Each period can have one of five weather identifiers that provide a range of potential evapotranspiriation (PET) and precipitation characteristics, from very dry to very wet. The selected PET and precipitation values affect some project yields (e.g., the Edwards aquifer) and customer demands. We chose a 50-year sequence of temperature and precipitation values for this simulation that closely matched the historic period beginning in the mid-1930s. The chosen starting point within this sequence causes the drought of record to begin in the first 10 years of the simulation. Other sequences would yield different cost estimates.

Inflation and discount rates. We used a 3 percent annual cost escalator (rate of inflation) for all capital and operating costs during the simulation. We also assumed that both the cost of capital (i.e., interest rate on construction loans) and the discount rate for the present value calculations equal 6 percent, annually. These assumptions make the construction of new water supply projects less expensive in today's dollars the further out into the future that SAWS builds them.

Water and reserve water shortages. The long-term water model projects that SAWS can meet customer demands each season of the 50-year span with no water shortages if the conservation program is in place. However, the model projects that SAWS cannot meet demand in the simulated drought of record years without the conservation program if the drought of record occurs in the first 10 years. Not enough new water projects could come on line within this period to meet SAWS' need during a severe drought. We assumed that SAWS would purchase additional Edwards aquifer water from irrigators in these critical years. The model projects that SAWS would need to purchase between 5,000 and 20,000 AF to cover the shortfall. We assumed a one-year emergency lease price of $250 per AF in 2002 dollars and operational costs (per acre-foot) identical to SAWS' other Edwards supplies.

The total capital and operating costs also include carrying enough excess capacity to meet SAWS' reserve requirements in most years. However, we allowed the simulations to fail to meet reserve requirements up to a cumulative total of 50,000 AF across the 50-year simulation period. A failure to meet reserve requirements only happens during very dry years when critical management period pumping restrictions reduce the supply available from Edwards aquifer-based projects. This is precisely the reason for carrying reserves and the Water Resources and Conservation Department shows similar results in their simulations (e.g., in a spreadsheet titled: "Long Term Comparison of Water Demand and Water Supply Projections, October 15, 2002"). We used a penalty of $150 per AF for not meeting reserves. This is slightly above the cost of leasing and pumping Edwards aquifer water and is therefore consistent with SAWS' current willingness-to-pay for supply reserves.

Results

Assuming the 167 and 185 GPCD scenarios represent the range of customer demands during the 2003 through 2052 period if SAWS had no conservation program in place, then:

- Over the next 50 years, SAWS' customers will use a cumulative total of between 2.9 and 4.5 million AF less water, or 19 to 27 percent less, with the conservation program in place; and
- The present value of SAWS' water resource capital and operating cost savings due to lower customer demands between 2003 and 2052 ranges from $0.6 to $1.0 billion in today's dollars.

Exhibit II-2 summarizes these results. The range of effects we cite above are derived by comparing the "with conservation" column and the "no conservation" columns.

Exhibit II-2.
Comparison of SAWS Water Demands and Resource Costs, With and Without Conservation, 2003 through 2052

2003 through 2052	*With Conservation*	*No Conservation Low Scenario*	*No Conservation High Scenario*
Total customer demands	12.3 million AF	15.2 million AF	16.8 million AF
Average annual demands	246,000 AF	304,000 AF	336,936 AF
PV capital and operating costs*	$1.94 billion	$2.55 billion	$2.98 billion
Savings		$0.61 billion	$1.00 billion

* Includes costs of water resources and water treatment plants.

Note: All dollar amounts are 2003 dollars.

Source: BBC Research & Consulting, 2003.

Reasons for the cost savings from conservation. Cost savings from conservation arise from lower operating and maintenance costs (e.g., project pipeline repairs and water treatment) and from avoiding (delaying or postponing) the capital costs associated with relatively expensive water supply projects. Reduced demands from conservation also affect the timing and sizing of the available water supply projects. For example, conservation:

- Allows SAWS to select a smaller version of the Alcoa/CPS project; and
- Delays the GBRA project development date by at least 44 years.

Exhibit II-3 shows the projected initial operation date for each available project in the model.

Exhibit II-3.
Supply Project Yields and First Year of Operation With and Without Conservation

		First Operational Year		
Project Description	*Base Yield (AF)*[1]	*With Conservation*	*No Conservation Low Scenario*	*No Conservation High Scenario*
ALCOA/CPS (55,000 AF Version)	55,000	2013	Not Used	Not Used
ALCOA/CPS (95,000 AF Version)	95,000	Not Used	2042	2037
ALCOA Colorado River Diversion at Bay City	42,625	Not Used	Not Used	Not Used
LCRA	100,000	2050	After 2052	2052
GBRA	94,500	After 2052	2009	2009
Recharge	6,725	2008	2008	2008
Gonzales	25,000	2007	2007	2007
Western Canyon	3,000	2005	2005	2005
ASR[2]	11,250	2005	2005	2005
Local Carrizo Production	14,000	2004	2004	2004
Oliver Ranch/BSR	5,000	2003	2003	2003
Groundwater/Edwards Permit	159,040	2003	2003	2003
Interim Groundwater Authorization	38,888	2003	2003	2003
Groundwater/Edwards Acquisitions/Leases	43,860	2003	2003	2003
Potable Water Exchange (for Recycled Water)	10,000	2003	2003	2003

Note: (1) Yield before drought or critical period impacts.
(2) Maximum storage in the ASR project is 11,250 AF, yield depends upon amount in storage.

Source: SAWS Water Resources and Conservation Department, 2002.

SECTION III.
Avoided Water Delivery and Wastewater Costs

The previous section described the estimated savings in water resource (or supply) expenditures attributable to SAWS conservation efforts. Costs of building and operating new water treatment plants were also examined.

This section describes estimated effects from conservation after treated water enters the water transmission and distribution system. We track these cost savings through the wastewater treatment system.

Background and Approach

Key assumptions. Several key assumptions drive the results.

As described in Section II, the Water Resources and Conservation Department provided BBC with three alternative demand projections for the years 2000 through 2050. These projections include a scenario with aggressive conservation, which represents SAWS' current planning, and two alternative projections of baseline demands without conservation.

To simplify the analysis, we further assumed that conservation results in:

- Equal reductions in indoor and outdoor water use;
- Equal reductions in average day, peak day and peak hour water use; and
- Wastewater flow reductions equivalent in percentage terms to the reduction in system demands.

Some of these assumptions greatly simplify the real world, which is consistent with the initial question for this research: what generally would happen if, by 2052, water demand were between 26 and 40 percent higher than demand with water conservation? Our results should be considered general indications of how conservation might result in cost savings.

Data sources. BBC began this assignment by interviewing SAWS staff responsible for water production, water transmission and distribution, wastewater collection and wastewater treatment. We then asked how they thought a given reduction in water use affects SAWS operations and capital improvements. We also met with Finance staff to review available financial information. SAWS staff were very consistent in identifying types of costs that water demand reductions would affect and costs that have already been saved.

BBC also interviewed staff from other utilities that have experienced large reductions in water demand due to conservation. We used these discussions to identify and confirm potential areas of cost savings. We also reviewed the 1996 AWWA publication, *Impacts of Demand Reduction on Water Utilities.*

BBC's cost analyses required specific allocation of capital and operating costs among different factors. For example, a portion of SAWS' water operating costs is related to the number of customers served (functions such as billing, customer service and meter reading). A reduction in water demand will not reduce these costs. Similarly, a reduction in indoor water use may lower total wastewater flows, but will not affect the total waste load in these flows. Costs such as wastewater treatment plant energy costs need to be pro-rated among factors such as volume, treatment capacity, strength-related factors (e.g., biochemical oxygen demand [BOD] and suspended solids) and number of wastewater customers.

To determine how SAWS costs should be allocated, BBC relied on the most recent rate study for SAWS, which was completed by Black & Veatch in 1996. We also analyzed the 2000 *Report on 1999-2009 Capital Improvement Plan and Maximum Impact Fees for Water, Water Supply, and Sanitary Sewer Systems*, again prepared by Black & Veatch. For certain costs, we compared the results we derived from these data sources with our own analysis of the most recent two years of SAWS financial reports. We also updated certain costs for inflation.

Water Delivery

After treatment, potable water enters the water main transmission system, a portion is pumped into high storage and the distribution system delivers the water to municipal and industrial customers.

Effect of conservation. SAWS staff already see operations and maintenance cost savings in portions of the water delivery system from reduced demand due to conservation. However, because the water distribution system extending from transmission mains to individual customers is designed to meet fire flows, the reduction in water demand does not save operating and capital costs in that part of the system.

Impact on water operating costs. There may be some production division costs saved because less water needs to be pumped through transmission lines and into high storage with lower demands. In addition, the cost of maintaining transmission mains is reduced with less demand on pipes. (SAWS currently sees the most need for transmission line repairs during periods when flows in the lines are at their highest.) With these reductions in costs, there may be some savings of general administration costs for distribution functions.

1996 rate study data. The 1996 Black & Veatch rate study estimated that $27.3 million of SAWS' $38.9 million in annual water utility operating expenditures were related to either the average volume or the peak day volume of water delivered to customers. Other operating costs were related to servicing meters, customer billing and fire flows, which are not affected by the amount of water use.

BBC only included a subset of the flow-related operating expenses when assessing the cost savings from conservation:

- We assume that the flow-related "all other planning" costs are reduced when total water usage is reduced. BBC did not assume any cost savings in watershed protection and management or "water resources" (except as described in Section II).

- We allocated the reduction in chemical and other production costs to water supply and treatment (covered in Section II), as these are primarily related to operation of SAWS' current well system.

- Maintenance service center costs related to water lines (not meters) are reduced with lower water demand.

- Electricity costs are somewhat lower with less water use because less water needs to be pumped through the system. We assumed that 10 percent of SAWS' total power costs are related to transmission of water, with the remainder allocated to production and treatment (see Section II).

- Portions of the line item "all other operating costs" are reduced through conservation.

- SAWS' overhead costs will drop if operating costs are reduced through conservation. Black & Veatch estimated that Finance and Administration, Engineering and General and Administrative costs amount to 46 cents for every dollar of other costs (not including utilities or chemicals). We assume no savings in the Finance and Administration costs spent on customer service.

Total savings in 2003. Exhibit III-1 shows that an estimated $12.7 million (33 percent) of the water operating costs in the 1996-1997 test year could be affected by conservation. Adjusted for inflation, this figure is $14.9 million in 2003. Under the low scenario, these costs would have been 14 percent higher without conservation and SAWS would have spent an additional $2.2 million. Under the high scenario, these costs would have been 27 percent, or $4.0 million, higher in 2003.

Exhibit III-1.
Annual Water Utility Operating Expenses
1996-1997 Test Year (Millions)

	Total Costs	*Costs Subject to Conservation Savings**
Planning		
Watershed protection and management	$0.7	$0.0
All other planning	2.2	2.2
Operations		
Utilities	6.1	0.6
Chemicals	0.1	0.0
All other production	5.4	0.0
Maintenance service centers	8.6	4.2
All other operations	2.4	1.9
Finance and Administration		
Customer service	3.1	0.0
All other Finance, Engineering and General and Administrative	10.3	3.8
Total	*$38.9*	*$12.7*
Updated to 2003 dollars		*$14.9*
Conservation Savings in 2003		
Low scenario (14%)		$2.2
High scenario (27%)		$4.0

* Does not include water resources costs. Excludes costs related to meters and services, customer billing and fire.

Source: BBC Research & Consulting from Black & Veatch, report *Comprehensive Costs of Service and Rate Design Studies,* 1996.

Alternate approach. BBC also examined SAWS' annual operating expenses by line item for FY 2001 (12 months ending May) and FY 2002 (calendar year) from monthly financial reports. We updated the costs used in the 1996 Rate Study through analysis of these data to test our previous analysis.

The monthly financial reports divide costs into system supply, water delivery, wastewater system, heating and cooling system and internal service fund. BBC grouped line items showing water delivery costs into the same categories as the rate study. We assumed that the percentage allocations of these cost categories among water flow, meters and services, customer billing and direct fire were the same as in 1996. From this, we derived a flow-related cost that could be reduced by conservation totaling $15.2 million per year (averaging FY 2001 and FY 2002). This analysis is very consistent with the results using the rate study data ($14.9 million estimate, updated to 2003 dollars). We used the lower figure generated from the rate study data to provide a more conservative estimate of cost savings due to conservation.

Growth in cost savings over time. The $2.2 to $4.0 million in annual water utility operating costs savings examined here will increase over time as demand grows, as the percentage savings from conservation increases, and due to inflation (assumed to be 3 percent per year). BBC accounted for these factors when determining future cost savings, described at the end of this section.

Impact on transmission and distribution capital costs. SAWS will also save some costs by postponing or avoiding expansion of certain water transmission and high storage facilities. However, SAWS will not save money in distribution line installation since these lines are sized to meet fire flows.

Depreciation of existing facilities. The reduction in system-wide water use might save some wear and tear on existing water transmission mains. In financial terms, this wear and tear is represented by depreciation. The 1996 Black & Veatch rate study estimated that $3.7 million of the annual depreciation for SAWS water mains (or $4.3 million in today's dollars) is related to water flows volume. BBC investigated developing an updated estimate of depreciation of water transmission mains from recent financial statements, but determined that the potential difference in results was small.

Other potential savings on existing facilities are minimal based on the amount of annual depreciation on items such as booster pumps and high storage tanks examined in the rate study. A 14 to 27 percent increase in this depreciation yields a minimal amount, so we have not included these costs. We also did not include depreciation on production pumps to avoid double counting water production cost savings (see Section II).

Savings on expansion of water mains and high storage. The 2000 Black & Veatch impact fee study assumes $1.6 million in new water main construction from 1999 to 2009 related to growth. The study also assumes $12.9 million in total costs for new high storage, booster pumps and other growth related items over this period. Together, these costs total about $15 million over the 10-year period, or about $1.5 million per year. (Because these costs are for the 1999 to 2009 period, we assume they are reflective of 2003 dollars.)

Total savings in 2003. Exhibit III-2 shows these average annual capital cost savings under the low and high conservation savings scenarios. Under the low scenario, the $4 million per year in these capital costs would have been 14 percent, or $0.6 million, higher in 2003 but for conservation. Under the high scenario, costs would have been $1.2 million higher in 2003.

Exhibit III-2.
Impact on Other Water Capital Costs (Millions)

	Total Flow-Related Costs (2003)	*Low Scenario (14%)*	*High Scenario (27%)*
Annual depreciation on existing water mains	$4.3	$0.6	$1.2
Annual budget for new water mains and high storage 1999-2009	1.5	0.2	0.4
Total	*$5.8*	*$0.8*	*$1.6*

Note: All dollar amounts are 2003 dollars.

Source: BBC Research & Consulting from Black & Veatch report, *Comprehensive Costs of Service and Rate Design Studies*, and Black & Veatch, report on 1999-2009 Capital Improvements Plan and Maximum Impact Fees for Water Supply, and Sanitary Sewer Systems, 2000.

Growth in cost savings over time. Cost savings will grow with increasing percentage savings from conservation under the low and high scenarios. Cost savings will also increase with inflation.

Depreciation cost savings will grow with increases in the size of the existing system and increases in percentage savings from conservation. Cost savings will also increase with inflation.

Wastewater System

SAWS wastewater system collects and treats wastewater from SAWS' water customers and some non-water customers. For this analysis, we assume that water demand reductions apply across SAWS' wastewater system despite some differences in service areas. We also assume that each percentage reduction in water demand leads to an equal percent reduction in total wastewater flows.

Effect of conservation. According to SAWS Wastewater Treatment Group staff, conservation has had a large effect on how SAWS is able to use its wastewater treatment plants. Reducing flows to the plants has allowed staff to better optimize the use of existing plants, which reduces operating costs and postpones certain capital investments. For example, the Dos Rios WWTP has the capacity to handle additional wastewater flows due to water conservation among the residents and businesses served by that plant. This has allowed SAWS to be able to shift some flows from Leon Creek, which is at capacity, to Dos Rios. SAWS can also take the Solado Creek plant off line. Four package plants will also soon to be taken off line. If water demands were significantly higher, SAWS would need to operate these plants and quickly build a new wastewater treatment plant farther west in its system.

The wastewater collection system is sized to handle peak flows that occur due to infiltration to the system during storms. Reductions in average flows due to conservation have minimal impact on design of the collection system. Similarly, lower average flows in existing pipes do not lead to maintenance savings. For some older pipes, low flows create more deterioration due to build-up of gasses.

However, SAWS also has hundreds of pump stations to convey wastewater to the treatment plants. The lower the total volume of wastewater to move, the lower the pumping costs.

Impact on wastewater operating costs. Wastewater treatment plant costs are influenced by the total volume of wastewater flows, the waste load in the flows, and peak flows. Conservation may reduce average daily flows through the wastewater treatment plants. It will not reduce total load, nor will it affect stormwater flows that enter the system, which contribute greatly to peak flows.

1996 rate study. BBC used Black & Veatch's 1996 rate study to apportion utility and maintenance expenses between capacity requirements and volume-related charges. In this study, Black & Veatch allocated $6.5 million of the $43.8 million in total annual wastewater operating expenses to total volume. These operating and maintenance costs include wastewater's share of administrative costs. The balance of the $43.8 million in costs was related to peak flows, load, industrial monitoring and number of customers, all of which would not be materially affected by a reduction in average daily water use.

The $6.5 million of volume-related costs in 1996 translates into $7.6 million in 2003 dollars. Exhibit III-3 shows these costs.

Exhibit III-3.
Impact on Annual Wastewater Utility and Maintenance Expenses (Millions)

	Total	*Volume-Related*
Planning		
Quality control	$1.7	$0.0
All other	1.1	0.5
Operations	7.0	0.0
Treatment		
Utilities	2.8	0.0
Chemicals	1.7	0.7
All other treatment	15.4	3.4
Finance and Administration		
Customer service	1.4	0.0
All other	5.3	0.8
Engineering	0.2	0
General and Administrative	7.2	1.1
Total Operating Expenses	*$43.8*	*$6.5*
Updated to 2003 dollars		*$7.6*
Conservation Savings in 2003		
Low scenario (14%)		$1.1
High scenario (27%)		$2.1

Source: BBC Research & Consulting from Black & Veatch report, *Comprehensive Costs of Service and Rate Design Studies*, 1996.

Total savings in 2003. A 14 percent increase in volume-related wastewater operating and maintenance costs, the low conservation savings scenario, would equal $1.1 million in 2003. Under the high scenario, costs would have been $2.1 million higher.

Growth in cost savings over time. The $1.1 to $2.1 million in wastewater utility operating costs savings would increase over time because of growth in baseline wastewater flows and higher projected percentage water demand savings from conservation and inflation. BBC accounted for these factors when determining future cost savings, as described at the end of this section.

Impact on wastewater capital costs. Avoided wastewater capital costs primarily relate to wastewater treatment facilities.

Depreciation of existing facilities. Most of SAWS' capital requirements in the existing wastewater treatment system are related to meeting peak flows and treating load, according to the 1996 rate study. Still, lower total flows might reduce the wear and tear on existing wastewater treatment plants and extend their life.

The rate study allocated only $4.6 million of the total $25.1 million in annual wastewater system depreciation to total volume. Most of this cost is within the wastewater treatment plants. Because this is a fairly small source of potential cost savings, and a very complicated analysis is necessary to derive total depreciation costs, we have not updated the depreciation estimate based on current wastewater treatment plant fixed assets. We only update the 1996 depreciation cost for inflation to reach $5.4 million in 2003 dollars.

Savings on expansion of wastewater treatment plants. Lower wastewater volume affects the total costs of building and expanding wastewater treatment plants to serve growth. SAWS is currently expanding the Medio Creek treatment facility. In the short run, higher wastewater treatment volume would primarily impact the costs of expanding this facility. We assume the short-run savings from conservation would apply on an average annual basis over the 50-year study period.

The Black & Veatch 2000 Impact Fee Study indicated it cost $750 per equivalent dwelling unit (EDU) for new wastewater treatment plants in the Outer Service Area (OSA). The 1996 rate study also estimated that 36 percent of total net wastewater treatment plant investment could be allocated to volume of wastewater flows. Using this ratio, about $270 per EDU of the $750 per EDU capital costs are volume-related.

The 2000 impact fee study assumed an annual increase of 8,829 EDUs per year from 1999 to 2009. Assuming this annual growth and $270 per EDU cost related to wastewater treatment plant volume, annual capital costs related to growth in wastewater treatment plant volume requirements average $2.4 million per year.

Total savings in 2003. Adding flow-related depreciation and new plant costs yields $7.8 million in costs in 2003. Assuming that wastewater treatment plant flows in 2003 would have been 14 percent higher without conservation under the low scenario means that SAWS will save $1.1 million in that year. If flows were 27 percent higher (high scenario), costs would be $2.1 million greater in 2003. Exhibit III-4 summarizes these average annual savings in wastewater capital costs.

Exhibit III-4.
Impact on Annual Wastewater Capital Costs (Millions)

	Total Volume-Related Costs (2003)	*Low Scenario (14%)*	*High Scenario (27%)*
Annual depreciation on existing wastewater treatment plants	$5.4	$0.8	$1.5
Annual costs for new wastewater treatment plants*	2.4	0.3	0.6
Total	*$7.8*	*$1.1*	*$2.1*

* Assumes capital costs of $750 per EDU for wastewater treatment plants in OSA, 36 percent of which is volume-related. Also assumes growth of 8,829 EDUs per year from 1999-2009.

Note: All dollar amounts are 2003 dollars.

Source: BBC Research & Consulting from Black & Veatch report, *Comprehensive Costs of Service and Rate Design Studies*, 1996 and Black & Veatch report, *Comprehensive Costs of Service and Rate Design Studies*, 2000.

Growth in cost savings over time. Cost savings related to new wastewater treatment plants will grow as percentage savings from conservation increase. Cost savings will also increase with inflation.

Savings in wear and tear on existing wastewater facilities will grow with increases in system size and increases in percentage savings from conservation. Costs will also increase with inflation.

Total Cost Savings from Conservation

Cost savings in 2003. Totaling all of the cost savings examined here, conservation may have reduced water delivery and wastewater costs by $5.2 and $9.8 million in 2003. Exhibit III-5 shows these savings.

Exhibit III-5.
Cost Savings in 2003 from Water Conservation (Millions)

	Low Scenario (14%)			*High Scenario (27%)*		
	Water	*Wastewater*	*Total*	*Water*	*Wastewater*	*Total*
Operating costs	$2.2	$1.1	$3.3	$4.0	$2.1	$6.1
Depreciation of existing plant	0.6	0.8	1.4	1.2	1.5	2.7
CIP projects	0.2	0.3	0.5	0.4	0.6	1.0
Total	*$3.0*	*$2.2*	*$5.2*	*$5.6*	*$4.2*	*$9.8*

Note: All dollar amounts are 2003 dollars.

Source: BBC Research & Consulting, 2003.

Present value of cost savings over 50 years. The annual operating capital cost savings are expected to grow over time due to:

- Inflation;
- System growth; and
- Increases in the percentage demand reductions from conservation. (Under the low scenario, demand would be 14 percent higher in 2003 and 26 percent higher by 2052. Under the high scenario, demand would be 27 percent higher in 2003 and 40 percent higher by 2052.)

We also assumed that the annual avoided costs of CIP projects would grow with inflation and increased percentage reductions from conservation.

BBC applied a 3 percent real discount rate (equivalent to a 6 percent nominal discount rate and a 3 percent inflation rate) in calculating present value of future cost savings. This is consistent with the water resources analysis discussed in Section II. Given these assumptions, the present value of cost savings under the low scenario is $260 million. The present value under the high scenario is $420 million.

Exhibit III-6.
Present Value of Water Delivery and Wastewater System Cost Savings from Conservation (Millions)

Low scenario	$260
High scenario	$420

Note: All dollar amounts are 2003 dollars.
Source: BBC Research & Consulting, 2003.

SECTION IV. Summary

SAWS Water Resources and Conservation Department retained BBC to estimate the cost savings experienced by SAWS as a result of conservation-related demand reductions. Section II of this report described estimated water resource (supply) cost savings. Section III described estimated cost savings in the water delivery and wastewater system. This section combines and summarizes BBC's analysis.

To assist in this evaluation, SAWS Water Resources and Conservation Department provided BBC with a range of potential demand reductions from conservation over the next 50 years. The "low scenario" begins in 2003 with a 14 percent demand reduction and the "high scenario" begins in 2003 with a 27 percent demand reduction. Further discussions of these two scenarios are provided in Section II, Exhibit II-1.

SAWS Conservation Program

SAWS currently spends less than $6 million per year on its conservation programs. Assuming that current costs were an even $6 million and that annual costs grew with inflation and system population growth over 50 years, its cumulative present value would be about $210 million. In other words, SAWS would need $210 million today to fund the next 50 years of conservation programs.

If we assume that the current level of annual conservation program expenditures creates the range of conservation savings examined in this report, one can gauge whether the conservation program "pays for itself." Based on the assumptions and calculations used in this analysis, the answer is "yes" — the present value of conservation program costs ($210 million) is $660 million less than the present value of cost savings even under the low scenario ($870 million). Under the high scenario, the present value of cost savings is $1.46 billion, a difference of $1.25 billion from the present value cost of conservation. Exhibit IV-1 provides a table of these results.

Exhibit IV-1.
Present Value of SAWS Avoided Capital and Operating Costs and Net Cost Savings under Proposed Reductions in Water Demand, 2003-2052 (Millions)

	Low Scenario	*High Scenario*
New water supplies and new water treatment plant cost savings	$610	$1,040
Cost savings from water transmission and wastewater facilities	260	420
Total	*$870*	*$1,460*
Cost of conservation	*$210*	*$210*
Net savings	*$660*	*$1,250*

Note: All dollar amounts are 2003 dollars.

Source: BBC Research & Consulting and SAWS, 2003.

If a comprehensive conservation program in the $6 million per year cost range has this type of long-term impact, it is more than worth than the investment. SAWS would see, on average, cost savings of about $4 to $7 for every dollar invested in conservation.

Impacts on Customers

Total customer water and wastewater revenue and impact fee requirements over the next 50 years are estimated to be reduced by $0.7 to $1.3 billion, on a present value basis, with the range of reductions in water demand examined in this study. Average monthly bills for SAWS customer will be lower than they would have been without a demand reduction.

Reductions in water sales due to conservation also reduce SAWS' revenues. Consequently, our findings do not mean that rates per 100 gallons of water use will decrease. The volume charge per 100 gallons may need to increase to offset lower water sales. Rather, the average total monthly water and wastewater bill and average impact fee are expected to be lower in the future if water demand continues to be reduced due to conservation.