



FINAL DRAFT Technical Memorandum

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Washington County Water Conservancy District

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To: Eric Millis, Utah Division of Water Resources
Ron Thompson, Washington County Water Conservancy District
Julie Breckenridge, Washington County Water Conservancy District

From: Bill Maddaus, Maddaus Water Management
Michelle Maddaus, Maddaus Water Management
Chip Paulson, Montgomery Watson Harza
Alicia Duran, Montgomery Watson Harza

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1. EXECUTIVE SUMMARY

1.1 Introduction

This conservation technical analysis was conducted by Maddaus Water Management (MWM) for the Washington County Water Conservation District (WCWCD). The purpose of the analysis was to:

1. Identify and evaluate current and new conservation measures that could be implemented by WCWCD to reduce future water demand.
2. Estimate the costs and water savings of those measures.
3. Combine the measures into increasingly more aggressive programs and evaluate the costs and water savings of the alternate programs.

1.2 Long-Term Conservation Program Analysis and Results

A list of 80 conservation measures considered potentially appropriate for the WCWCD service area was developed from known technology and services that would save water. Thirty-seven conservation measures selected by Washington County community representatives were further analyzed and combined into alternative component programs of increasingly higher water savings and implementation costs (Table ES-2).

Program A (continue current program, 14 measures), B (add 11 new measures to current program), and C (implement all 37 measures considered). Table ES-1 shows water savings for 2035, 2050 and 2060, and benefit-cost ratios computed for 30 years for each of these programs. Water savings, in 2050, range from 28,700 to 41,600 AF. Conservation program water savings, in 2060, range from 38,000 to 54,000 AF.

Table ES-2 shows the relative water savings (AF/Yr), and program costs (\$ millions) for the utility, and community and cost of water saved (\$/AF) of the alternate programs. The community perspective includes the utility plus the customer's costs and benefits. Additional resources and customer participation are required to reach higher levels of potential water savings. The plumbing code is included as passive baseline savings in addition to the long-term conservation program in Programs A-C. Most of the future program water savings consist of outdoor landscape improvements. Up to 21 percent of the new potable water needed by WCWCD to accommodate planned growth could be met through aggressive conservation by 2060.

Program A reflects estimated water savings derived from continuing the current program and the plumbing code. The additional measures that create programs B and C produce increasing incremental water savings and costs. Because of prior conservation efforts Program B will meet the states goal of a 25% reduction in potable use by 2060

Table ES-1

Conservation Program Description and Future Water Savings

Conservation Program	Description	2035 Water Savings* (AF/Yr)	2050 Water Savings* (AF/Yr)	2060 Water Savings* (AF/Yr)	Portion of Water Needed for New Growth from 2007 to 2060**
-	No Conservation Programs, Plumbing Code Only	4,625	7,474	9,599	4%
A	Continue Current Conservation Program (15 measures) and Plumbing Code	16,666	28,706	37,997	15%
B	Add 13 Cost-Effective Measures to Current Program A and Plumbing Code	22,909	38,651	50,760	20%
C	Add 9 More Measures to Program B and Plumbing Code	25,182	41,592	54,030	21%

*Water savings start in the year 2007 for the existing programs. 2007 is the base year for the model.

**"Portion of new water needed" is relative to growth in demand without plumbing code.

Table ES-2

Economic Analysis of Alternative Programs

Conservation Program	Water Utility Benefit-Cost Ratio	Community Benefit-Cost Ratio	2035 Culinary Water Savings (AF/Yr)	2035 Indoor Water Savings (AF/Yr)	2035 Outdoor Water Savings (AF/Yr)	Total Culinary Water Savings as a % of Total Culinary Production in 2035	30-Year Present Value of Water Utility Costs (\$1,000s)	First Five Year Total Utility Costs (\$1,000s)	30 Year Utility Cost of Water Saved (\$/AF/Yr)	30 Year Community Cost of Water Saved (\$/AF/Yr)
Plumbing Code Only	NA	NA	4,624	4,624	0	3.2%	NA	NA	0	0
Program A + Plumbing Code	4.8	1.8	16,663	5,552	11,111	11.7%	\$ 17,968	\$ 5,744	\$ 92	\$ 261
Program B + Plumbing Code	4.6	1.7	22,905	10,735	12,170	16.1%	\$ 29,238	\$ 9,176	\$ 98	\$ 328
Program C + Plumbing Code	3.7	1.3	25,178	12,052	13,126	17.7%	\$ 41,153	\$ 13,385	\$ 122	\$ 446

2. INTRODUCTION AND PURPOSE

The purpose of Technical Memorandum 2 is to present an overview of the conservation evaluation process which has been completed for Washington County Water Conservation District (WCWCD). Based on the analysis of current water use patterns presented in Technical Memorandum 1 a list of 80 measures that could be used to expand existing efforts was compiled and reviewed with the District and cities in a measure screening workshop. During the workshop 37 measures were selected for further analysis. A water savings, cost and benefit evaluation was performed on all of the selected measures. Based on the individual measure results, three programs (Program A, B and C) were developed by MWM. The three programs evaluate the net effect of running multiple measures together over time.

WCWCD and member cities have demand management programs, as documented in the Lake Powell Pipeline Water Needs Assessment (WNA) July 2010. Technical Memorandum 2 builds on the information presented in the Phase I Report and evaluates whether expanding existing efforts is feasible and a cost-effective way to meet future water needs.

The conservation measures and three programs were analyzed using the Least Cost Planning Water Demand Management Decision Support System (DSS Model). In this report demand management and water conservation are used interchangeably. The evaluation includes measures directed at existing accounts as well as new development measures to make new residential and business customers more water efficient. Assumptions and results for each of the 37 individual measures and three programs will be described in detail in this memorandum.

2.1 Contents

This technical memorandum provides a general overview for the methodology, assumptions, and results for the conservation analysis. The following information is included in this memorandum and is discussed in individual sections below:

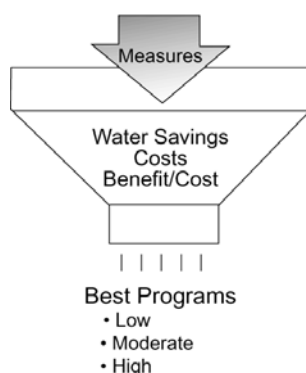
- Overview of evaluation process
- Baseline water demands with and without the plumbing code
- Comparison of individual conservation measures
- Results of conservation program evaluation
- Conclusions
- Appendix A: Assumptions for the conservation measures evaluated

3. OVERVIEW OF EVALUATION PROCESS

Long Term Conservation Evaluation Process

During the evaluation process, water savings were estimated and cost assumptions for the measures were developed by MWM and WCWCD Staff. Benefits and costs were compared in a formal present value analysis and conclusions were drawn about which measures produce cost-effective water savings. This process can be thought of as an economic screening process, shown in Figure 1. Packaging the best measures into alternative programs allows WCWCD to consider what level of conservation is appropriate.

Figure 1
Evaluation Process



Benefit-cost analysis has been used by many water agencies to evaluate and help select a water conservation measure best suited to local conditions. This analysis requires a locale-specific set of data, such as historical water consumption patterns by customer class, population projections, age of housing stock, and prior conservation efforts.

The following eight steps were used to implement the methodology by expanding upon the same DSS Model used to prepare the demand projections.

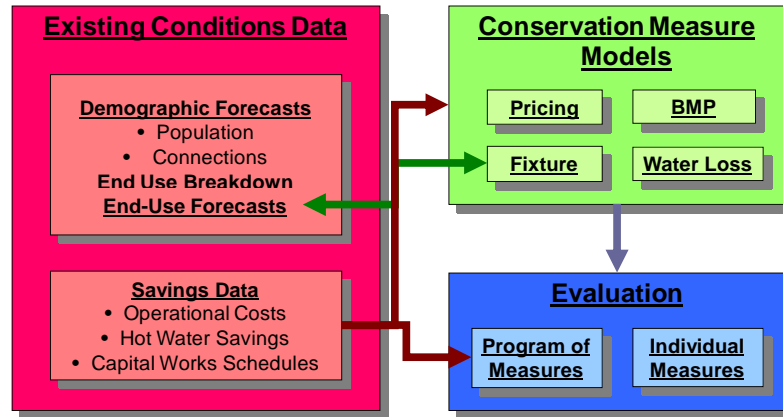
1. **Use WNA Phase II Study results to represent water use projections without the national plumbing code.** Projections cover each key customer category and are broken down into indoor and outdoor end uses. Evaluate the impact of the plumbing code changes arising from the 1992 and 2005 Federal Energy Policy Act. The baseline water use projections (demand projections) for this project, without the plumbing code or any water conservation were derived from the Final Demand Projections for the Water Needs Assessment July 2010.
2. **Identify possible water conservation measures and screen the measures qualitatively** to identify those that are applicable to the service area. Develop appropriate unit water savings and cost factors for each measure.
3. **Estimate the affected customers (or number of accounts) for each conservation measure** by dividing the measure's projected customers (or accounts) that implements the measure by the total service area customers (accounts). This factor is called the market penetration or installation rate.
4. **Estimate total annual average day water savings.** The water savings are computed by multiplying unit water savings, per measure, by the market saturation or installation rate (i.e. 10% to 90% of accounts), and then multiplying by the number of units in the service area (such as dwelling units) targeted by a particular measure. The indoor and outdoor water savings were also calculated.
5. **Determine initial and annual costs to implement the measures** based upon pilot projects, local experience, and the costs of goods, services, and labor in the community. This is multiplied by the number of units participating each year and then added to overall administration and promotion costs to arrive at a total measure cost, which may be spread over a number of years.
6. **Compare costs of measures** by computing the present value of costs and costs of water saved over the planning period.
7. **Compile three programmatic packages** or programs containing various new and existing measures.

8. **Evaluate the three programs for water savings and cost-effectiveness** and identify the point of diminishing returns from further investments in conservation.

For conservation measure evaluation, the DSS Model performs economic analysis by using net present value and benefit-to-cost ratio as economic indicators. The benefit cost analysis is performed from various perspectives including the utility and community (community perspective equates to the utility plus customer). Figure 2 shows the structure of the model. Results are presented in subsequent sections.

Figure 2

Structure of the DSS Model



4. BASELINE WATER DEMANDS WITH AND WITHOUT PLUMBING CODE

Water demand projections were input for 30 years from 2007 to 2037 using the DSS Model. This model incorporates information from the:

- Water Needs Assessment July 2010.
- Utah Governor’s Office of Planning and Budget (GOPB) population forecasts.
- Data provided by WCWCD staff including estimates for value of water saved, historical water use, past conservation efforts, and water system facilities.

National Plumbing Code

The Federal Energy Policy Act of 1992, as amended in 2005 requires only fixtures meeting the following standards can be installed in new buildings:

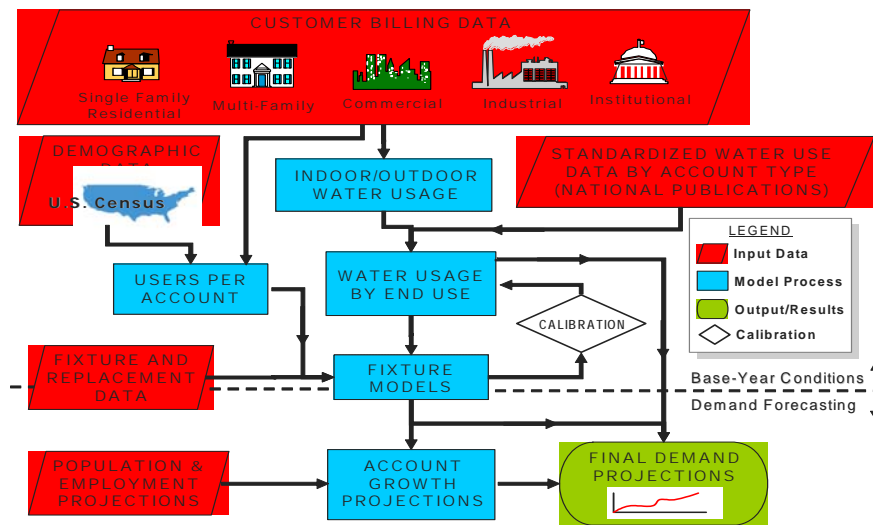
- Toilet – 1.6 gal/flush maximum
- Urinals – 1.0 gal/flush maximum
- Showerhead - 2.5 gal/min at 80 psi
- Residential Faucets – 2.2 gal/min at 60 psi
- Public Restroom Faucets - 0.5 gal/min at 60 psi
- Dishwashing pre-rinse spray valves – 1.6 gal/min at 60 psi

Replacement of fixtures in existing buildings is also governed by the Federal Energy Policy Act that requires only devices with the specified level of efficiency (shown above) can be sold today (2010). The net result of the plumbing code is that new buildings will be more efficient and old inefficient fixtures will slowly be replaced with new more efficient models. The national plumbing code is an important piece of legislation and must be carefully taken into consideration when analyzing the overall water efficiency of a service area.

In addition to the plumbing code the US Department of Energy regulates appliances such as residential clothes washers. Regulations to make these appliances more energy efficient has driven manufactures to dramatically reduce the amount of water these efficient machines use. Generally horizontal axis washing machines use 30-50 percent less water than conventional models (which are still available). In the analysis for WCWCD, the DSS Model forecasts a gradual transition to high efficiency clothes washers so that by the year 2020 this will be the only type of machines purchased. Given that machines last about 15 years eventually all machines in the WCWCD area will be of this type.

Figure 3 below describes conceptually how the above listed items are incorporated into the flow of information in the DSS Model.

Figure 3
DSS Model Overview Used to Make Potable Water Demand Projection
“With the Plumbing Code”



4.1 Key Assumptions for the DSS Model

Table 1 shows the key assumptions used in the model. The assumptions having the most dramatic effect on future demands are the natural replacement rate of fixtures, how residential or commercial future use is projected, and finally the percent of estimated real water losses.

- Base Year - This is the starting year for the analysis. For this project, a base year of 2007 was selected as an appropriate starting point. It was the most recent year for which water billing data was available and not impacted by external factors such as a recession and water restrictions which occurred in 2008.
- Average gal/day/acct - This is the amount of water in gallons that is used per day, per account.
- Average gal/day/capita - This is the amount of water in gallons that is used per day, per capita.
- Indoor/outdoor water use - This is the amount of water per account split into the percent that is used indoors and outdoors.
- Consumption by customer class - This shows the annual amount of water used for an entire calendar year, broken down by customer class including Single Family, Multifamily, and Non-Residential (includes Commercial, Institutional, Industrial).
- Non-Revenue Water (also known as Unaccounted for Water) - Sum of all water input to system that is not billed (metered and unmetered) water consumption, including apparent (metering accuracy) and real losses. An average value of 6 percent was used for future planning purposes.
- Water Produced - This is the total amount of potable water produced by WCWCD net of existing and planned recycled water.

Figure 4 shows the potable water demand projection at five-year increments. The graph shows projections for demand with and without the plumbing code through 2060.

Table 2 presents the culinary water demands projection, which includes the following:

1. The water demand projections are based on the Water Needs Assessment July 2010.
2. Projections were made *with and without* the plumbing codes.

The plumbing codes and appliance standards will reduce 2060 demands 9,599 AF/Yr or 3.8 percent of demands without the plumbing code. Further reductions in demand due to voluntary and regulatory conservation measures are calculated from an end use version of the demands “with plumbing code”.

Table 1**List of Baseline Demand Projection Assumptions for DSS Model**

Parameter	Model Input Value, Assumptions, and Key References
Base Year	2007
Non-Revenue Water, % of Water Production	Non-Revenue Water 6% assumed from billing and production data
Population and Employment Projection, 2005 to 2060	Utah Governor's Office of Planning & Budget
Number of Water Accounts for Base Year	2007 Billing Data
Distribution of Water Use Among Categories	2007 Billing Data
Indoor/Outdoor Water Use Split by Category, % of Total	Estimated from Billing Data
Residential End Uses, %	AWWARF Report "Residential End Uses of Water" 1999
Non-Residential End Uses, %	Professional judgment and AWWARF Report "Commercial and Institutional End Uses of Water" 1999
Efficient Residential Fixture Current Installation Rates	Census 2005, Housing age by type of dwelling plus natural replacement plus rebate program (if any). Reference "High Efficiency Plumbing Fixtures - Toilets and Urinals" Koeller & Company July 23, 2005. Reference Consortium for Efficient Energy (www.cee1.org)
Water Savings for Fixtures, gal/capita/day	AWWARF Report "Residential End Uses of Water" 1999
Non-Residential Fixture Efficiency Current Installation Rates	Census 2005, assume commercial establishments built at same rate as housing, plus natural replacement
Residential Frequency of Use Data, Toilets, Showers, Washers, Uses/user/day	Estimated based on AWWARF Report "Residential End Uses of Water" 1999
Non-Residential Frequency of Use Data, Toilets and Urinals, Uses/user/day	Estimated based on AWWARF Report "Commercial and Institutional End Uses of Water" 1999
Natural Replacement Rate of Fixtures	Residential Toilets 3% (post-1992 toilets), 3% (pre-1992) Commercial Toilets 3% (post-1992 toilets), 3% (pre-1992) Commercial Urinals 4% Residential Showers 4% Residential Clothes washers 6.67% A 3% replacement rate corresponds to 33 year life of a new fixture. A 6.67% replacement rate corresponds to 15 year washer life based on "Bern Clothes Washer Study, Final Report, Energy Division, Oak Ridge National Laboratory, for U.S. Department of Energy, March 1998, Internet address: www.energystar.gov
Future Residential Water Use	Increases Based on Total Demand Projection
Future Non-Residential Water Use	Increases Based on Total Demand Projection

Figure 4

Baseline Average Day Culinary Water Use Projections for WCWCD Culinary System

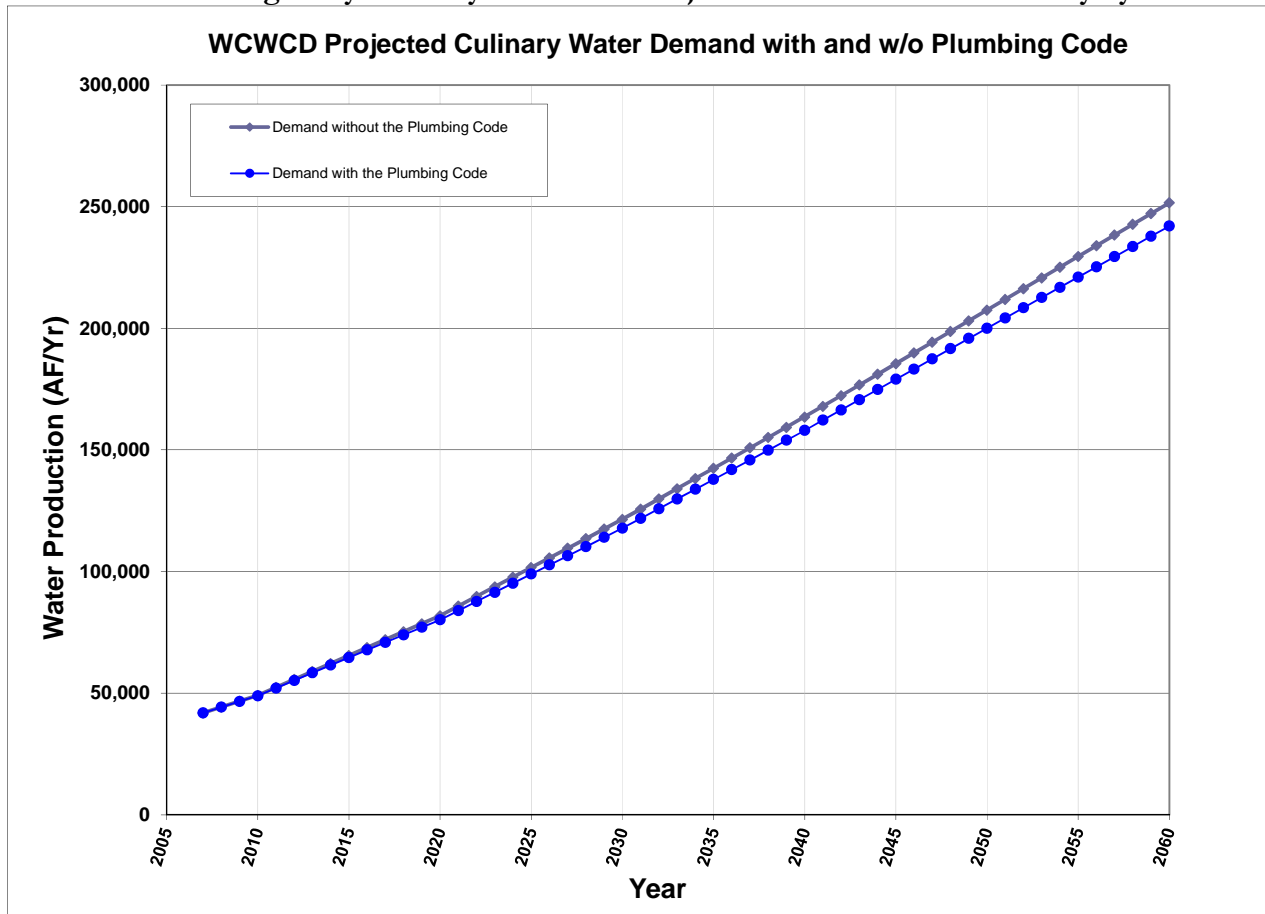


Table 2

Baseline Average Day Culinary Water Use Projections for WCWCD Culinary System

Data Source for Population Projection	Plumbing Code	Water Production, Average Day (AF/Yr)*									
		2007	2010	2015	2020	2025	2030	2035	2040	2050	2060
Utah GOPB	Not Included	41,915	49,130	65,519	81,878	101,707	121,498	142,500	163,583	207,518	251,658
Utah GOPB	Included	41,915	48,918	64,663	80,187	98,981	117,817	137,876	158,040	200,045	242,060

*Note: Mix of culinary and secondary water demand is the same in the future as in 2005. This does not assume that new secondary systems would allow for replacement of culinary-grade water used outdoors with secondary-grade water. Baseline demand projection assumes no conservation of any type is implemented. Plumbing code only assumes that the national plumbing code is implemented over time.

5. COMPARISON OF INDIVIDUAL CONSERVATION MEASURES

5.1 Selecting Conservation Measures to be Evaluated (Conservation Measure Screening)

A list of 80 potential conservation measures considered potentially appropriate for the WCWCD service area was developed by MWM. The list was comprised of known technology and services that included devices or programs (e.g., such as a new high-efficiency toilet) that would save water if installed or practiced by WCWCD, contractor, or customer. Descriptions of the potential conservation measures were developed that addressed the methods through which a device or program will be implemented, including the distribution method, or mechanism, that would be used to activate the device or program. The full list of conservation measures was provided in Technical Memo 1.

A screening process was undertaken to reduce the number of measures and eliminate those measures that overlap each other to avoid double counting, or are not as well suited to the Washington County area. Screening was performed in a workshop facilitated by MWH and attended by representatives of WCWCD and the major cities in Washington County. The list of measures was further reviewed by WCWCD staff, where additional measures were added and others adjusted to reflect the WCWCD service area demographics. In the end 37 measures were selected for evaluation with the DSS Model. Table 3 describes the 37 conservation measures evaluated in the DSS Model. Assumptions for the individual measures are described in the next section.

Table 3

Conservation Measures Evaluated in the DSS Model

Measure No.	Device or Program	Applicable Category	Measure Description
ALL CUSTOMER CATEGORIES			
Indoor			
W1	Promote Green Buildings	SF, MF, COM, INS	Staff a position to work with local Green Building associations, developers, designers, vendors to promote incorporating water efficiency into building design. Measure includes costs to recognize outstanding participants through co-sponsor award program.
W2	Twenty Gallon Challenge	SF	The 20-Gallon Challenge is a call for residents to reduce water use on average by 20 gallons per person, per day.
W3	Financial Incentives for Irrigation Upgrades	SF, MF, COM, INS	For existing SF, MF, and COM, customers with landscape, provide rebates towards the purchase and installation of selected types of irrigation equipment upgrade including low volume sprinkler heads, check valves, and rain sensors. Rebate is up to one-half of cost of equipment or a maximum of \$350 for residential accounts and up to \$650 for mixed use accounts and up

Measure No.	Device or Program	Applicable Category	Measure Description
			to \$10,000 for irrigation accounts. Assume average rebate to be \$2,500 for non-Residential accounts.
W4	ND Require New Landscape and Irrigation Requirements	SF, MF, COM	Enforce a regulation that specifies that homes or buildings be landscaped according to Xeriscape principals, with appropriate plant selection and irrigation systems.
W5	Smart Irrigation Controller Rebates	SF, MF, COM, INS	Provide a 50% cost-share up to \$400 for the purchase of a SMART irrigation controller. Require customer has a "Water Check" and education. Assume about 0.15% of eligible SF and 2% of Non-SF accounts take rebates per year.
W6	Turf Removal	SF, MF, COM, INS	A \$1.50 per square foot incentive is available for removing existing turf and replacing with desert landscaping or synthetic turf. Maximum rebate of \$5,000. Average rebate of \$1,500 for SF accounts and \$2,500 for Non-SF accounts. The replacement of irrigated vegetation with desert landscaping or synthetic turf may significantly reduce outdoor watering needs.
W7	Regulate Water Softeners	SF, MF, COM, INS	Eliminate one percent of pre-1999 water softeners every year. Offer a \$150 rebate for replacement of an existing time clock operated softener with a demand initiated softener. Require all new homes to have a demand initiated softener (no rebate), if a softener is installed, follow EPA WaterSense guidelines for particular types to be used.
RESIDENTIAL			
Indoor			
W8	Distribute Retrofit Kits	SF	Provide owners of pre-1992 homes with retrofit kits that contain easy-to-install low flow showerheads, faucet aerators, and toilet tank retrofit devices. Distribute at booths.
W9	Toilet Leak Detection	SF	Distribute leak detection tablets for homeowners to test toilets for leaks; offer advice on toilet leak repair. Continue "fix the leak week" campaign.
W10	Washer Rebates	SF	Homeowners would be eligible to receive a rebate on a new water efficient clothes washer. It is assumed that the rebates would remain consistent with relevant state and federal regulations (Department of Energy, Energy Star) and only offer the best available technology.
W11	Washer Rebates for High Efficiency Machines	SF	Same as above, except that a higher rebate is offered for higher efficiency machines. Combine with W10, put rebate on a sliding scale, and vary with water efficiency of

Measure No.	Device or Program	Applicable Category	Measure Description
			new machine. Water rebate averages \$150, total rebate higher if local Energy Company participates.
W12	High Efficiency Toilet (HET) Rebates	SF, MF, COM, INS	Provide a \$150 rebate or voucher for the installation of a high efficiency toilet (HET). HET's are defined as any toilet to flush 20% less than an ULFT and include dual flush technology. Rebate amounts would reflect the incremental purchase cost. Program length will be short as it is intended to be a market transformation measure and eventually would be stopped if 1.3 gpf toilets are mandated by state or federal law.
W13	Single Family Water Surveys	SF	Continue outdoor water surveys, "Water Checks", for existing single-family residential customers. Normally those with high water use are targeted and provided a customized report to the homeowner on how to save water in their home. Assume 1% of accounts surveyed per year.
W14	Multifamily Surveys	MF	Outdoor water surveys for existing multifamily residential customers (2 units or more). Normally those with high water use are targeted and provided a customized report to owner. 1% of accounts surveyed per year.
W15	Multifamily Washer Rebate (Intensive)	MF	Provide a \$400 rebate to apartment complexes (10 or more units) for efficient washing machines in buildings over a certain size that has a common laundry room. It is assumed that the rebates would remain consistent with relevant state and federal regulations (Department of Energy, Energy Star) and only offer the best available technology.
W16	ND Require Hot Water on Demand/Structured Plumbing Program	New SF	Incentivize all homes with rebate program to equip new homes or buildings with efficient hot water on demand systems such as structured plumbing systems. These systems use a pump placed under the sink to recycle water sitting in the hot water pipes to the water heater or to move the water heater into the center of the house and/or reduce hot water waiting times by having an on-demand pump on a recirculation line.
W17	ND Require Multi Family Submetering on New Accounts	New MF	Require the metering of individual units in new multi-family, condos, townhouses, mobile-home parks and business centers (less than four stories and with water heater in the units). Utility administrators meter read and bill program.
W18	Garbage Disposal SF	SF	Provide a \$100 rebate to encourage 1% of single family homeowners per year to remove garbage disposals.

Measure No.	Device or Program	Applicable Category	Measure Description
Outdoor			
W19	Public Information Program	SF	Public education would be used to raise awareness of other conservation measures available to customers. Programs could include school programs, poster contests, speakers to community groups, radio and television time, and printed educational material such as bill inserts, etc. Program would continue indefinitely. Fund at the level of \$2.50 per residential account per year.
W20	Conservation Pricing	SF	Existing single family water rates would be changed to create an added price incentive to use less water. Single family rates would be changed to adjust the tiers or rates in the upper tiers to increase the incentives to reduce landscape watering. Would require a water rate study to develop specific pricing levels.
W21	New Home Award Programs (Patterned after WaterSense)	New SF	Provide annual awards to developers that are “Green Builders” and offer homes for sale that meet certain criteria such as EPA’s new Water Sense program for new homes. This could be combined with energy efficient homes or measure W1.
W22	Efficient Outdoor Use Education and Training Programs	SF	Utility would offer, organize and sponsor a series of educational workshops for homeowners in efficient landscaping and irrigation principals. Utilize guest speakers, Xeriscape demonstration gardens, incentives, such as a nursery plant coupon. Target approx 0.5% of homes per year.
W23	Rotating Sprinkler Nozzle Rebates	SF, MF, COM, INS	Programs like SoCal WaterSmart program offers a rebate of up to \$4 per rotating nozzle for single-family properties. Work with irrigation supply companies to promote.
COMMERCIAL, INDUSTRIAL, INSTITUTIONAL			
Indoor			
W24	CII Surveys	COM, INS	High water use accounts would be offered a free water survey that would evaluate ways for the business to save water and money. Assume 0.5% of accounts are surveyed per year for 10 years (reach top 5% of accounts by end of program).

Measure No.	Device or Program	Applicable Category	Measure Description
W25	CII Rebates to Replace Inefficient Equipment	COM, INS	Provide up to a \$1,000 rebate for a standard list of water efficient equipment. Included would be x-ray machines, icemakers, air-cooled ice machines, steamers, washers, spray valves, efficient dishwashers, replace once through cooling, and add conductivity meters on cooling towers. Pattern after San Diego County Water Authority or Seattle Water Department programs. Assume 3% market saturation. Offer to audited sites; assume average rebate is \$1,000.
W26	Replace Restaurant Spray Nozzles	COM, INS	Provide free installation of 1.6 gpm (or lower) spray nozzles for the rinse and clean operation in restaurants and other commercial kitchens. Provide free installation to 25% of pre-2006 sites. Program length 2-5 years.
W27	Award Programs for Water Savings by Businesses	COM, INS	Providers would sponsor an annual awards program for businesses that significantly reduce water use. They would receive a plaque, presented at a lunch with the mayor. Assume 3 large sites participate every two years reducing use ~25%. Large means >10,000 gal/day.
W28	High Efficiency Urinal Rebate (<0.25 gallon)	COM, INS	Provide a rebate of \$200 for high efficiency urinals to existing high use CII customers (such as restaurants). Eligible replacements would include urinals flushing with no more than 0.25 gpf and best available technology (1 pint). Assume 1.0% of accounts participate per year.
W29	Focused Water Audits for Hotels/Motels	COM	Provide free water audits to hotels and motels. Standardize on the types of services offered to reduce costs. Included would be bathrooms, kitchens, ice machines, cooling towers, landscaping, and irrigation systems and schedules. Audit 40 of (older or high use) accounts over 10 years.
W30	School Building Retrofit	INS	Run a program patterned after MWD of Southern California's school retrofit program wherein school receives a grant to replace fixtures and upgrade irrigation systems. Assume 10% of schools participate over 10 years.
Outdoor			
W31	Irrigation Water Surveys	INS	All public and private irrigators of landscapes would be eligible for free landscape water surveys upon request. Normally those with high water use would be targeted and provided a customized report. Assume 5 % of large turf areas are surveyed per year. Three year program then repeat (3 year measure life).

Measure No.	Device or Program	Applicable Category	Measure Description
W32	Artificial Turf Sports Fields	INS	Provide a rebate (up to \$80,000) for customer to install artificial grass on one sports field per year.
W33	ND Require Irrigation Designers/Installer be Certified	New MF, COM, INS	Require installation of irrigation systems that are efficient and installed by trained/certified contractors. Certification to be done by St. George. New program planned for 2010.
W34	Xeriscape Demonstration Gardens	SF	Donate or acquire a portion of public or private land to create a demonstration garden displaying living examples of low water-using gardens and landscaping. The Utility would provide signs and brochures to educate those people visiting the garden. Second garden in planning stages. Costs to be determined. Possibly combine with W19.
W35	Train Landscape Maintenance Workers	MF, COM, INS	Utility would sponsor bilingual training for managers and workers in landscape maintenance methods that will save irrigation water. Work with Dixie State and USU Extension.
W36	ND Prohibit Once through Cooling, Non-Recycling Fountains, Water Wasting Fixtures and Practices	New COM, INS	Prohibit certain obvious wastes of water in new facilities, such as those listed.
SYSTEM			
W37	Real Water Loss Reduction	System	Measure covers efforts to find and repair leaks in the distribution system to reduce real water loss and take other actions (such as meter replacement) to reduce apparent water losses thereby improving the system water balance. A ten year program to reduce unaccounted for water to 10 percent of production or less is proposed for this measure. Actions could include installation of data loggers and proactive leak detection; accelerated meter replacement could be done over 10 years. Leak repairs would be handled by existing crews at no extra cost. Specific goals and methods to be developed by the Utility Operations Department.

SF Single Family

MF Multi Family (greater than 2 units)

COM Commercial

ND New Development Regulation

INS Institutional

5.2 Perspectives on Benefits and Costs

The determination of the economic feasibility of water conservation programs depends on comparing the costs of the programs to the benefits provided. The analysis was performed using the DSS Model. The DSS Model calculates savings at the end-use level; for example, the model determines the amount of water a toilet rebate program saves in daily toilet use for each single family account.

Present value analysis is used to discount costs and benefits to the base year. From this analysis benefit-cost ratios of each measure are computed. When measures are put together in programs the interactions are accounted for by multiplying water use reduction factors together at the end use level. A water use reduction factor is 1.0 minus the water savings, expressed as a decimal. This avoids double counting when more than one measure acts to reduce the same end use of water.

Economic analysis can be performed from several different perspectives, based on which party is affected. For planning water conservation programs for utilities, the perspectives most commonly used for benefit-cost analyses include the utility and the community. The “utility” benefit-cost analysis is based on the benefits and costs to the water provider. The “community” benefit-cost analysis includes the utility benefit and costs together with account owner/customer benefits and costs. These include customer energy and other capital or operating cost benefits plus costs of implementing the measure, beyond what the utility pays.

The utility perspective offers two advantages for this analysis. First, it considers only the program costs that will be directly borne by the utility. This enables the utility to fairly compare potential investments for saving and supplying water. Second, because revenue shifts are treated as transfer payments, the analysis is not complicated with uncertainties associated with long-term rate projections and retail rate design assumptions. Because it is the water provider’s role in developing a conservation plan that is paramount in this study, the utility perspective was primarily used to evaluate elements of the plan.

The community perspective is defined to include the utility and the customer costs and benefits. Costs incurred by customers striving to save water while participating in conservation programs are considered, as well as the benefits received in terms of reduced energy bills (from water heating costs) and wastewater savings, among others. Other factors external to the utility, such as environmental effects, are not included in the benefit-cost analysis. Because these external factors are often difficult to quantify, are not necessarily under the control of the utility, they are therefore frequently excluded from economic analyses, including this one.

5.3 Present Value Parameters

The time value of money is explicitly considered. The value of all future costs and benefits is discounted to 2007 (the base year) at the real interest rate of 3.0%. The DSS Model calculates this real interest rate, adjusting the current nominal interest rate (assumed to be approximately 6.1%) by the assumed rate of inflation (3.0%). Cash flows discounted in this manner are herein referred to as “Present Value” sums.

5.4 Assumptions about Measure Costs

Costs were determined for each of the measures based on industry knowledge, past experience and data provided by WCWCD. Costs may include incentive costs, usually determined on a per-participant basis; fixed costs, such as marketing; variable costs, such as the costs to staff the measures and to obtain and maintain equipment; and a one-time set-up cost. The set-up cost is for measure design by staff or consultants, any required pilot testing, and preparation of materials that will be used in marketing the measure. Measure costs were estimated for 30 years, (each year between 2007 and 2037). Costs were spread over the time period depending on the length of the implementation period for the measure and estimated voluntary customer participation levels.

Lost revenue due to reduced water sales is not included as a cost because the conservation measures evaluated herein generally take effect over a span of time that is sufficient to enable timely rate adjustments, if necessary, to meet fixed cost obligations.

5.5 Assumptions about Avoided Costs

Future benefits from program water savings can be considered to be future costs that are avoided because the water conservation program makes these expenditures unnecessary or delayed in time (creating a savings in the present value of future costs). The critical need for future water supply in Washington County can be clearly seen from Fig ES-8 "WCWCD Supply and Demand - Total" from the Lake Powell Pipeline Study, Water Needs Assessment, July 2010. The figure shows that WCWCD would exhaust current local supplies around the year 2027. After that 70,000 acre-feet of Lake Powell pipeline water would meet needs until about 2037. Additional wastewater reuse would meet needs until 2041, at which time new (and at the time unidentified) supplies would be needed to accommodate growth. The Water Needs Assessment (Figure ES-8) includes the assumption of 25 percent water conservation by 2050, relative to 2000 per capita use.

To address this identified water need MWH prepared a report for WCWCD, dated May 2010, entitled:

Conceptual Water Treatment Study For Pah Tempe Hot Springs and Virgin River Water Sources

Excerpt from report page 7-1

The treatment system option proposed for the WCWCD project water supply project, using the two local water sources identified (Pah Tempe Springs and the Virgin River), will provide a finished water supply that would: 1) meet the SDWA water quality objectives, and 2) provide a process that could reliably be used to satisfy the current and future potable water supply objectives for each alternative water source. The report provides an opinion of the estimated conceptual capital and operating cost for the two flow/source options requested by the WCWCD. The summarized capital and O&M costs are provided on Tables 7-1, 7-2 and 7-3. Table 7-1 provides our opinion of cost for a system that would use both evaporation (20%) and deep well injection (80%) for brine disposal. Opinion of costs are derived from the information developed in Section 6. We assumed that some storage/evaporation capacity (20%) would be used to handle peak flows in summer when evaporation will be at its maximum. Table 7-2 presents an option that would rely on pond storage and enhanced evaporation alone for brine disposal. In addition, a brine recovery option that would minimize the volume of brine produced and use evaporation of the remaining concentrate is presented Table 7-3.

**Table 7-1
Summary of Capital and First Year* Annual O&M
Opinion of Preliminary Cost**

Option	RO Treatment Components		Brine Recovery & Disposal Component**	
	Capital	Annual O&M	Capital**	O&M
25,000 gpm	\$115,600,000	\$11,975,000	\$77,576,000	\$3,877,000
*Based on Year 2010				
**Estimated with Brine Recovery and Enhanced Pond Evaporation for Concentrate Disposal (100%)				

For this conservation evaluation it is assumed that the above projects will be needed at some point, after 2027 depending upon the actual growth in demand, effectiveness of conservation programs, and schedule for Lake Powell Pipeline, etc.

- Delay in above capital expenditures for treatment and brine disposal (due to lower demand caused by planned conservation program between 2010 and 2027)
- Delay in operating expenses shown above for treatment and brine disposal.

Future benefits are discounted to the base year as stated above to compute the Present Value figures reported in this memorandum. Roughly speaking the planned conservation programs evaluated in this study will delay the need for these projects approximately four + years. The higher the conservation savings the longer the delay. So, for example, the capital savings will be the difference of the discounted cost (present value) of a project built in 2027 versus 2032 plus the savings of about four years of operating costs, discounted to the present time. We observed that about 90 percent of the cost savings is due to the delay in operating costs and 10 percent of the savings are due to capital cost deferral. The total utility benefit calculated this way ranges from about \$86,000,000 for Program A to \$135,000,000 for Program B to over \$152,000,000 for Program C. (Programs are defined in Section 6.)

5.6 Measure Assumptions including Unit Costs, Water Savings, and Market Penetrations

In evaluating the water conservation measures selected by WCWCD and the cities, MWM made assumptions that influence the results obtained from the DSS Model. Table 2 includes assumptions in the DSS Model for each of the following variables for all measures modeled:

- Targeted Water User Group; End Use – Water user group (e.g., single-family residential) and end use (e.g., indoor or outdoor water use).
- Utility Unit Cost (for contractor) – Cost of rebates, incentives, and contractors hired (by the utility) to implement measures.
- Retail Customer Unit Cost – Cost for implementing measures that is paid by retail customers (i.e., the remainder of a measure’s cost that is not covered by a utility rebate or incentive).
- Utility Administration and Marketing Cost – The cost to the utility administering the measure, including consultant contract administration, marketing, and participant tracking. The mark-up is sufficient (in total) to cover local agency conservation staff time and general expenses and overhead.

Appendix A summarizes all the water savings and cost assumptions for each measure. The unit costs vary according to the type of account and implementation method being addressed. For example, a measure might cost a different amount for a residential single family account, than a residential multifamily account, and for a rebate versus a direct installation implementation method. Typically water utilities have found there are increased costs associated with achieving higher market saturation, such as more surveys per year. Table 4 shows the unit costs used. The model calculates the annual costs based on the number of participants each year. The general formula for calculating annual utility costs is:

Annual Utility Cost = Annual market saturation x total accounts in category x unit cost per account x (1+administration and marketing markup)

Annual Customer Cost = Annual number of participants x unit customer cost

Annual Community Cost = Annual Utility Cost + Annual Customer Cost

Table 4

Unit Costs of Conservation Measures Evaluated in the DSS Model

No.	Conservation Measure	Basis of Costs	Utility Unit Costs,\$	Admin & marketing mark-up, %	Customer Unit Costs, \$
W1	Promote Green Buildings	Per account	SF=\$75 MF, COM = \$150 INS=\$200	25	SF=\$250 MF, COM, INS=\$500
W2	Twenty Gallon Challenge	Per account	SF=\$25	25	SF=\$25
W3	Financial Incentives for Irrigation Upgrades	Per account	SF=\$350 MF, COM, INS =\$2,500	25	SF=\$200 MF, COM =\$2,500
W4	ND Require New Landscape and Irrigation Requirements	Per account	SF=\$50 MF, COM, =\$150 INS =\$200	30	SF=\$500 MF, COM=\$1,000 INS = \$2,000
W5	Smart Irrigation Controller Rebates	Per account	SF=\$250 MF, COM, INS =\$400	30	SF=\$250 MF, COM, INS =\$400
W6	Turf Removal	Per account	SF=\$1,500 MF, COM, INS =\$2,500	30	SF=\$1,500 MF, COM, INS =\$2,500
W7	Regulate Water Softeners	Per account	SF=\$150 MF, COM, INS =\$150	30	SF=\$250 MF, COM, INS =\$250
W8	Distribute Retrofit Kits	Per account	SF=\$25	25	SF=\$25
W9	Toilet Leak Detection	Per account	SF=\$5	25	SF=\$25
W10/ W11	Washer Rebates	Per washer	SF=\$150	30	SF=\$150
W12	High Efficiency Toilet (HET) Rebates	Per toilet	ALL=\$150	25	ALL=\$50
W13	Single Family Water Surveys	Per	SF=\$75	25	SF=\$10

No.	Conservation Measure	Basis of Costs	Utility Unit Costs,\$	Admin & marketing mark-up, %	Customer Unit Costs, \$
		account			
W14	Multifamily Surveys	Per account	MF=\$150	25	MF=\$50
W15	Multifamily Washer Rebate (Intensive)	Per account	MF=\$400	30	MF=\$200
W16	ND Require Hot Water on Demand/Structured Plumbing Program	Per account	SF=\$50	25	SF=\$500
W17	ND Require Multi Family Submetering on New Accounts	Per account	MF=\$50	30	MF=\$2,500
W18	Garbage Disposal SF	Per account	SF=\$100	30	SF=\$50
W19/ W34	Public Information Program	Per account	SF=\$2.50	10	0
W20	Conservation Pricing	Per account per year	SF=\$2.00-5.00	10	0
W21	New Home Award Programs (Patterned after WaterSense)	Per account	SF=\$50	30	SF=\$500
W22	Efficient Outdoor Use Education and Training Programs	Per class	SF=\$1,000	30	SF=\$300 per participating account
W23	Rotating Sprinkler Nozzle Rebates	Per account	SF=\$50 MF, COM, =\$250 INS =\$500	25	SF=\$50 MF, COM=\$250 INS = \$500
W24	CII Surveys	Per account	COM, INS=\$2,000	25	COM, INS=\$2,000
W25	CII Rebates to Replace Inefficient Equipment	Per account	COM, INS=\$1,000	30	COM, INS=\$1,000
W26	Replace Restaurant Spray Nozzles	Per account	COM, INS =\$150	25	0
W27	Award Programs for Water Savings by Businesses	Per account	COM=\$1,000	30	COM,=\$5,000
W28	High Efficiency Urinal	Per urinal	COM, INS=\$200	30	COM, INS

No.	Conservation Measure	Basis of Costs	Utility Unit Costs,\$	Admin & marketing mark-up, %	Customer Unit Costs, \$
	Rebate (<0.25 gallon)				=\$400
W29	Focused Water Audits for Hotels/Motels	Per account	COM= \$1,000	25	COM =\$2,000
W30	School Building Retrofit	Per account	INS =\$5,000	25	INS =\$5,000
W31	Irrigation Water Surveys	Per account	INS =\$1,500	30	INS =\$1,000
W32	Artificial Turf Sports Fields	Per account	INS =\$80,000	20	INS =\$900,000
W33	ND Require Irrigation Designers/Installer be Certified	Per account	COM = \$100, INS=\$200	30	COM = \$500, INS=\$1,000
W35	Train Landscape Maintenance Workers	Per account	MF, COM, =\$100 INS =\$100	30	MF, COM, =\$100 INS =\$100
W36	ND Prohibit Once through Cooling, Non-Recycling Fountains, Water Wasting Fixtures and Practices	Per account	COM = \$25, INS=\$50	30	COM = \$100, INS=\$200
W37	Real Water Loss Reduction	System	Year 1-3: \$292k/Yr; >Yr 3 \$275k/Yr	0	0

SF Single Family MF Multi Family (greater than 2 units)
COM Commercial INS Institutional

5.7 Comparison of Individual Measures

Table 5 presents how much water the measures would save over 30 years, how much they would cost, and what cost of water saved is *if the measures were run on a stand-alone basis (i.e. without interaction or overlap from other measures that might address the same end use(s))*. Only the net or highest water savings for overlapping conservation measures was included in each program.

Economic indicators are defined below:

- *Utility costs:* those costs that the utility would spend.
- *Customer costs:* those costs customers would spend to participate in WCWCD programs and maintaining its effectiveness over the life of the measure.
- *Community costs:* Community costs include utility and customer costs to implement measures.

- *Costs for the utility:* include measure set-up, annual administration, and payment of rebates or purchase of devices or services as specified in the measure design.

The column headings in Tables 5 are defined as follows:

- *2035 Water Savings (MGD) = water savings in 2035 (MGD) where MGD = million gallons per day*
- *Present Value of Utility, Customer, Community Costs = 30 year present value of the time stream of annual costs*
- *Cost of Savings per Unit Volume (\$/AF, by cost category) = NPV of Category Costs divided by 30-year Average Water Savings * 365 where AF = acre feet*
- *Utility Benefit-Cost ratio = NPV of utility benefits/NPV of utility costs over 30 years.*
- *Community Benefit-Cost ratio =(NPV of Utility Benefits plus NPV of customer energy savings)/NPV of utility costs plus NPV of customer costs)*

From Table 5 the following observations can be made

- There is a considerable range in savings from very small savings to well over 4,000 AF in 2035.
- Twenty nine of the measures are cost-effective (BC ratio > 1.0) from the utility perspective.
- Twenty two of the 37 measures are cost-effective (BC ratio > 1.0) from the community perspective.
- Many of the measures with the highest water savings target landscape water use.
- Measures that target or apply to new homes save more water than measures that target existing customers because of the relatively high planned growth for the service area.
- Three of the top five water saving measures in 2035 (first column of Table 3) are existing programs or a modification of an existing program (all save over 1,400 AF in 2035):
 1. Landscape requirements on new homes (an existing program) (W4)
 2. Water conservation pricing (modify existing program) (W20)
 3. Certification of irrigation designers/installers (an existing program) (W33)
 4. Regulate water softeners (W7)
 5. Reduction of unaccounted for water (W37)
- The three most expensive measures for the utility (last column in Table 3) over the first five years of the study period are:
 1. Turf removal (W6)
 2. Financial incentives for irrigation upgrades (W3)
 3. Real water loss reduction (W37)

Table 5

Conservation Measure Costs and Savings

No.	Measure	Year 2035 Water Savings (AF/Yr)	Present Value of Water Utility Costs,(\$)	Utility Benefit Cost Ratio	Community Benefit Cost Ratio	Utility Cost of Savings per Unit Volume (\$/AF)	Community Cost of Savings per Unit Volume (\$/AF)	First Five Years of Utility Cost, (\$)
W1	Promote Green Buildings	704	\$1,488,481	3.19	2.14	\$142	\$518	\$341,861
W2	20 Gallon Challenge	303	\$394,201	5.68	7.07	\$76	\$136	\$67,182
W3	Financial Incentives/Rebates for Irrigation Upgrades	688	\$4,974,283	1.26	0.78	\$313	\$509	\$1,851,951
W4	Landscape Requirements for New Systems	4,314	\$3,162,393	9.54	1.15	\$46	\$383	\$695,411
W5	Smart Controller Rebates	748	\$1,096,380	6.23	3.52	\$64	\$112	\$408,118
W6	Turf Removal Program	1,062	\$7,320,218	1.32	0.75	\$342	\$606	\$2,570,012
W7	Regulate Water Softeners	1,798	\$1,267,634	9.43	0.82	\$48	\$712	\$358,846
W8	Distribute Retrofit Kits	0	\$61,094	0.00	0.95	\$627	\$1,129	\$33,591
W9	Toilet Leak Detection	0	\$12,219	0.00	0.00	\$129	\$643	\$6,718
W10-W11	Washer Rebates	58	\$762,457	0.75	2.22	\$488	\$864	\$419,217
W12	High Efficiency Toilets Rebates	137	\$1,606,019	0.79	0.62	\$482	\$611	\$1,010,425
W13	Single Family Residential Water Surveys - Exterior	273	\$1,241,529	1.63	1.47	\$243	\$269	\$201,547
W14	Multifamily Residential Water Surveys -Exterior	26	\$126,475	1.52	1.20	\$276	\$350	\$22,203
W15	Multifamily Washer Rebates	41	\$223,989	1.79	6.80	\$204	\$282	\$123,154
W16	Hot Water System for New Development	1,045	\$2,747,595	2.56	0.75	\$178	\$1,598	\$670,404
W17	MF Submetering on New	323	\$151,344	14.51	0.92	\$31	\$1,271	\$36,927
W18	Garbage Disposal SF	1	\$50,830	0.20	0.33	\$1,974	\$2,734	\$27,948
W19-W34	Residential Public Education	340	\$1,820,909	1.41	2.52	\$266	\$266	\$295,602
W20	Water Conservation Pricing	2,695	\$1,848,797	9.22	10.93	\$52	\$52	\$200,000
W21	New Home Efficiency Awards	1,165	\$1,221,153	6.48	1.26	\$70	\$768	\$297,957
W22	Education/Training External Water Use Efficiency	292	\$688,844	2.60	0.71	\$175	\$643	\$195,000

No.	Measure	Year 2035 Water Savings (AF/Yr)	Present Value of Water Utility Costs,(\$)	Utility Benefit Cost Ratio	Community Benefit Cost Ratio	Utility Cost of Savings per Unit Volume (\$/AF)	Community Cost of Savings per Unit Volume (\$/AF)	First Five Years of Utility Cost, (\$)
W23	Rotating Sprinkler Nozzle Rebates	156	\$421,596	3.39	1.89	\$117	\$211	\$231,726
W24	Commercial Water Audits	44	\$394,337	1.02	1.33	\$390	\$702	\$216,538
W25	CII Replace Inefficient Equipment	14	\$123,033	1.01	0.57	\$392	\$694	\$67,560
W26	Restaurant Spray Nozzle Replacement	6	\$16,181	3.34	33.94	\$106	\$106	\$18,750
W27	Award Program for Water Savings Business	93	\$171,336	3.31	1.43	\$137	\$665	\$29,898
W28	Commercial Urinal Rebates	13	\$139,607	0.88	0.34	\$439	\$1,140	\$76,661
W29	Water Audits Hotels-Motels	25	\$39,171	5.91	2.27	\$66	\$172	\$24,375
W30	School Retrofit	315	\$214,943	13.42	11.16	\$30	\$53	\$118,029
W31	Irrigation Surveys	431	\$219,932	14.65	9.68	\$27	\$41	\$38,378
W32	Artificial Turf - Irrigation Customer Sports Field Program	81	\$742,560	1.00	0.10	\$396	\$4,104	\$407,754
W33	Require Irrigation Designer/Installer Certification	2,676	\$1,043,122	17.41	4.87	\$26	\$94	\$252,872
W35	Train Landscape Workers	166	\$433,490	2.85	1.61	\$144	\$254	\$75,828
W36	Prohibit Inefficient Use in New Accounts	294	\$130,132	15.13	3.41	\$30	\$133	\$31,477
W37	Real Water Loss Reduction	1,417	\$4,999,982	2.13	2.13	\$204	\$204	\$1,460,833

Note: Water savings are for year 2035 only; measures that have a measure life may be with zero because they have expired. These measures do save water in the early years of the planning period but not in 2035.

6. RESULTS OF CONSERVATION PROGRAM EVALUATION

6.1 Selection of Measures for Programs

Table 6 provides a summary of which measures are included in each of the three draft alternative programs. The three packages are designed to illustrate an increasing level of water savings for WCWCD, with the third level (Program C) representing the maximum theoretical level of water savings. The decision of which measures go into each program will be reviewed and finalized by WCWCD and City staff.

These programs are not intended to be rigid programs but rather to demonstrate the range in savings that could be generated if selected measures were run together. In this step we account for a percent overlap in water savings (and benefits) and estimate combined savings and benefits from programs or packages of measures.

Each program builds on the prior program. Program A is the least intensive considered, approximating a continuation of the current WCWCD program, and contains 14 measures. Program B includes Program A measures and 11 additional measures. The measures in Program B was a selected by WCWCD. Program C has all 37 measures evaluated.

Table 6
Conservation Measures Selected for Programs

No.	Measure Name	Program A	Program B	Program C
W1	Promote Green Buildings		X	X
W2	Twenty Gallon Challenge		X	X
W3	Financial Incentives for Irrigation Upgrades	X	X	X
W4	ND Require New Landscape and Irrigation Requirements	X	X	X
W5	Smart Irrigation Controller Rebates	X	X	X
W6	Turf Removal			X
W7	Regulate Water Softeners			X
W8	Distribute Retrofit Kits		X	X
W9	Toilet Leak Detection	X	X	X
W10/11	Washer Rebates			X
W12	High Efficiency Toilet (HET) Rebates	X	X	X
W13	Single Family Water Surveys	X	X	X
W14	Multifamily Surveys			X
W15	Multifamily Washer Rebate (Intensive)		X	X
W16	ND Require Hot Water on Demand/Structured Plumbing Program			X
W17	ND Require Multi Family Submetering on New Accounts			X
W18	Garbage Disposal SF			X

No.	Measure Name	Program A	Program B	Program C
W19/34	Public Information Program	X	X	X
W20	Conservation Pricing	X	X	X
W21	New Home Award Programs (Patterned after WaterSense)		X	X
W22	Efficient Outdoor Use Education and Training Programs	X	X	X
W23	Rotating Sprinkler Nozzle Rebates		X	X
W24	CII Surveys			X
W25	CII Rebates to Replace Inefficient Equipment			X
W26	Replace Restaurant Spray Nozzles	X	X	X
W27	Award Programs for Water Savings by Businesses		X	X
W28	High Efficiency Urinal Rebate (<0.25 gallon)			X
W29	Focused Water Audits for Hotels/Motels		X	X
W30	School Building Retrofit		X	X
W31	Irrigation Water Surveys		X	X
W32	Artificial Turf Sports Fields		X	X
W33	ND Require Irrigation Designers/Installer be Certified	X	X	X
W35	Train Landscape Maintenance Workers	X	X	X
W36	ND Prohibit Once through Cooling, Non-Recycling Fountains, Water Wasting Fixtures and Practices	X	X	X
W37	Real Water Loss Reduction		X	X
TOTAL NUMBER OF MEASURES*		14	25	37

*Totals include consolidated measures W10/11 and W19/34, each of which counts as two measures in the total

6.2 Results of Program Evaluation

Figure 5 shows annual water demand with no conservation, plumbing code only, and the three draft programs. The plumbing code reduces water production 3.2 percent by 2035. The alternate programs reduce production in 2035 as follows:

- Program A savings are 8.5 percent or including the plumbing code 11.7 percent.
(8.5% Program A+ Plumbing Code 3.2% = Total Savings 11.7%)
- Program B savings are 12.9 percent or with the plumbing code 16.1 percent
(12.9% Program B+ Plumbing Code 3.2% = Total Savings 16.1%)
- Program C savings are 14.5 percent or with plumbing code 17.7 percent
(14.5% Program C+ Plumbing Code 3.2% = Total Savings 17.7%)

The graphs in Figure 5 depict the demand with the alternative conservation programs and the plumbing code.

Figure 5
Long Term Demands with Conservation Programs

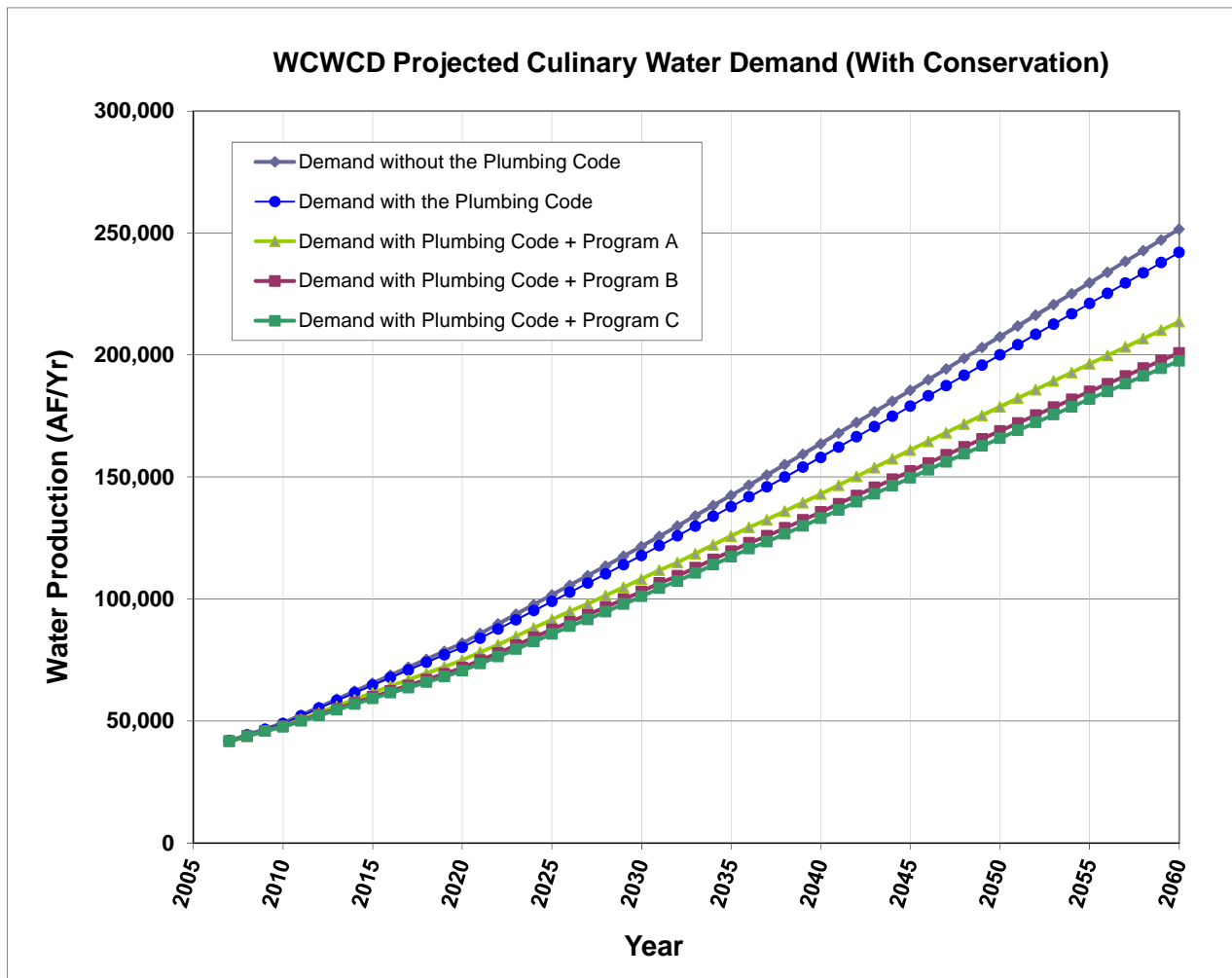


Table 7 presents key evaluation statistics compiled from the DSS Model. Assuming all measures are successfully implemented, projected water savings for 2035 in AF are shown, as are the costs of achieving this reduction. Water savings for programs have been extrapolated to 2060 in Table 5. The normal planning (analysis) period for the DSS Model is 31 years.

The water savings were extrapolated to 2060 as follows:

1. The annual rate of water savings for the plumbing code and Programs A, B, C, relative to the no plumbing code or conservation case, was computed for each scenario over the last ten years in the analysis period (2027-2037).
2. This rate of change for each scenario was used to compute the water savings and then the demand with the code and Programs A, B, C in place for each year from 2038 to 2060 (23 years).
3. The rate of change varied from a reduction in water use of 0.026%/yr for the plumbing code to 0.10%/yr for Program A to 0.12%/yr for Program C.

The costs are expressed two ways.

1. Total present value over the analysis period.
2. The cost of water saved. Cost of water saved is presented two ways: for the utility and the total community (customer plus utility).

These cost parameters are derived from the annual time stream of utility, customer and community costs.

The water savings are expressed as a percentage of the projected 2035 potable demand. One column indicates the percentage of the new water demand in 2035 each program could provide. The new water needed by new customers over the full planning period the difference between 2007 demand of 41,900 AF/Yr and 2060 demand of 251,650 AF/Yr without the plumbing code. The new water needed for WCWCD for potable purposes by 2060 is 209,700 AF/Yr. Approximately 25 percent of the new potable water needed by WCWCD to accommodate planned growth could be met through aggressive conservation with Program C, and 21 percent of new potable demand could be met through a more modest conservation program like Program B.

Figure 6 graphically depicts the three programs. Program A reflects continuing the current program plus the plumbing code. The additional measures that create programs B and C produce increasing incremental costs for the amount of water savings gained. In other words there are apparent diminishing returns when measures are added to each program beyond Program B. That is not to say that extending the water savings to Program C, the theoretical maximum determined in the study, is a poor investment. Whether it is economical to spend the extra money depends on the cost of the other options to obtain additional water for the WCWCD area, if needed.

Figure 6

Present Value of Utility Costs versus Cumulative Water Saved

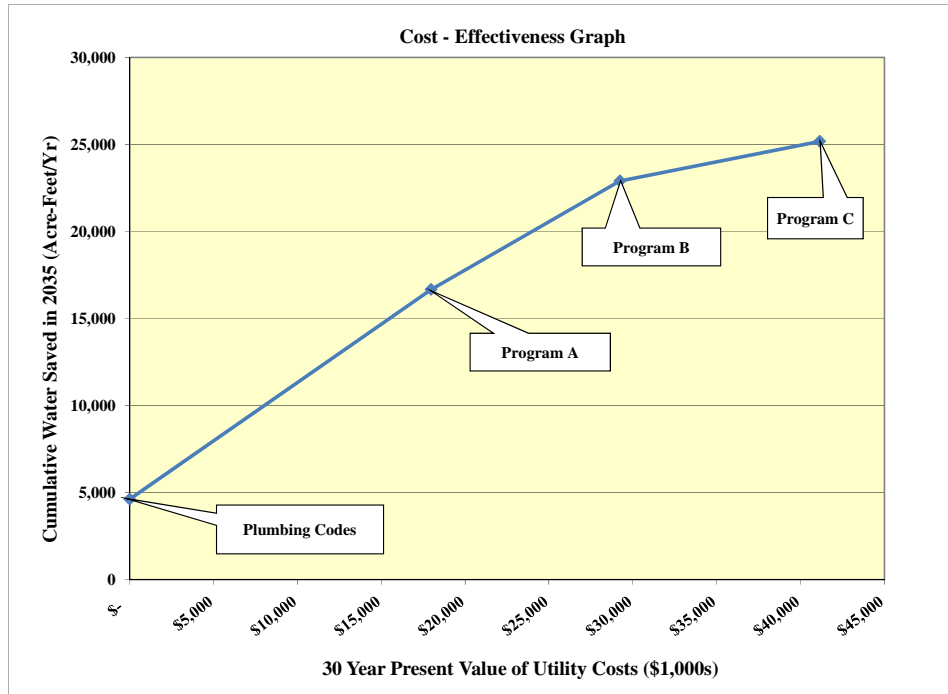


Table 7

Comparison of Long-Term Conservation Programs - Costs and Savings

Results of Culinary Water Conservation Program Evaluation

Conservation Program	Water Utility Benefit-Cost Ratio	Community Benefit-Cost Ratio	2035 Culinary Water Savings (MGD)	2035 Culinary Water Savings (AF/Yr)	2035 Indoor Water Savings (AF/Yr)	2035 Outdoor Water Savings (AF/Yr)	Total Culinary Water Savings as a % of Total Culinary Production in 2035	Water Savings Extrapolated to 2060 (AF/Yr)	30-Year Present Value of Water Utility Costs (\$1,000s)	First Five Year Total Utility Costs (\$1,000s)	30 Year Utility Cost of Water Saved (\$/AF)	30 Year Community Cost of Water Saved (\$/AF)	% of New Culinary Water Needed for Growth by the year 2060
Plumbing Code Only	NA	NA	4.1	4,624	4,624	0	3.2%	9,599	NA	NA	0	0	4%
Program A + Plumbing Code	4.8	1.8	14.9	16,663	5,552	11,111	11.7%	37,992	\$ 17,968	\$ 5,744	\$ 92	\$ 261	17%
Program B + Plumbing Code	4.6	1.7	20.4	22,905	10,735	12,170	16.1%	50,753	\$ 29,238	\$ 9,176	\$ 98	\$ 328	23%
Program C + Plumbing Code	3.7	1.3	22.5	25,178	12,052	13,126	17.7%	54,023	\$ 41,153	\$ 13,385	\$ 122	\$ 446	25%

Notes:

- Present Value is determined using an interest rate of 3%
- Cost of water saved is present value of water utility cost divided by total 30-year water savings.
- * % of water saved refers to the demand without the plumbing code
- Total water savings in 2035 as a percent of production is relative to no plumbing code production

7. CONCLUSIONS

7.1 Relative Savings and Cost-Effectiveness of Programs

The WCWCD service area has a relatively high portion of residential water use and a significant amount of outdoor water use. Consequently, residential conservation programs produce the most savings. WCWCD's service area is not a heavy manufacturing sector so the conservation potential in the commercial sector is relatively low. The amount of new growth forecasted for WCWCD's area is high so measures directed at new development produce large savings. Because of the high avoided cost of new water, water conservation programs are very cost-effective. Overall conclusions are:

- Total savings from Program A + Plumbing Code (continuing the current program) would save approximately 11.7 percent of demand in 2035 (16,600 AF) as shown in Table 7.
- The maximum savings would be that of Program C + Plumbing Code or 25,200 AF in 2035. This equates to a 17.7 percent reduction in 2035 water demand, as shown on Table 7.
- Program C + Plumbing Code would save 54,000 AF in 2060 which is 21 of projected 2060 water demand without the plumbing code.
- Considering the water saved to date achieving the State of Utah's goal of a 25 percent reduction by 2050 appears to be within reach of either Program B or C, both of which are cost effective, from the utility standpoint.
- The average cost of water saved to the utility (present value basis) for all programs ranges from a very attractive \$92 to \$122 per AF (less than the \$620/AF projected price of Lake Powell water to Washington County), as shown in Table 7.
- The average community cost of water saved ranges from an attractive \$261 to \$446 per AF ((less than the \$620/AF projected price of Lake Powell water to Washington County), as shown in Table 7.
- Program B appears to optimize the investment in water conservation whose costs and savings are at the point of increasing diminishing returns, as seen in Figure 6. Program B is also sufficient to meet the state's goal of a 25% reduction in per capita water use, give the historical savings that have already been achieved.
- Because of the projected relatively high growth rate in new accounts, implementation of all of the programs described in this report will save approximately 25 percent of the amount of new water needed in 2060. Water conservation can be an important approach to meeting future demands in the service area.

Appendix A - Assumptions for Water Conservation Measures Evaluated in the DSS Model

Washington County Selected Measure Number	W1	W2	W3	W4	W5	W6
	Promote Green Buildings	Twenty Gallon Challenge	Financial Incentives	New Development Landscape Requirements	Smart Irrigation Controller Rebates	Turf Removal
Applicable Customer Classes	New SF, MF, COM, INS	SF	SF, MF, COM, INS	New SF, MF, COM	SF, MF, COM, INS	SF, MF, COM, INS
Applicable End Uses	INDOOR	ALL EXCEPT IRR	Irrigation	Irrigation	Irrigation	Irrigation
Market Penetration by End Of Program	25%	10%	15%	65%	0.15% SF accounts per year; 2% MFR/COM/INS accounts per year	0.5% for all accounts per year
Water Use Reductions For Targeted End Uses	5%	10%	15%	15%	10%	40%
Evaluation Start Year	2010	2010	2007	2007	2007	2010
Program Length, years	40	40	15	40	15	15
Measure Life, years	permanent	10	permanent	permanent	permanent	permanent
Utility Unit Cost for SF accounts, \$/unit	\$ 75	\$ 25	\$ 350	\$ 50	\$ 250	\$ 1,500
Utility Unit Cost for MF and COM accounts, \$/unit	\$ 150		\$ 2,500	\$ 150	\$ 400	\$ 2,500
Utility Unit Cost for INS accounts, \$/unit	\$ 200		\$ 2,500	\$ 200	\$ 400	\$ 2,500
Customer Unit Cost. SF accounts \$/unit	\$ 250	\$ 25	\$ 200	\$ 500	\$ 250	\$ 1,500
Customer Unit Cost. MF-COM accounts, \$/unit	\$ 500		\$ 2,500	\$ 1,000	\$ 400	\$ 2,500
Customer Unit Cost. INS accounts, \$/unit	\$ 500		\$ 2,500	\$ 2,000	\$ 400	\$ 2,500
Administration, Mark-up	25%	25%	25%	30%	30%	30%
Comments				Assume effective in 65% of new accounts		

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Washington County Selected Measure Number	W7	W8	W9	W10/11	W12	W13
	Regulate Water Softeners	Distribute Retrofit Kits	Toilet Leak Detection	Washer Rebates	HET Rebates	Single Family Water Surveys
Applicable Customer Classes	SF, MF, COM, INS	SF	SF	SF	SF, MF, COM, INS	SF
Applicable End Uses	Other	Shower, Toilet, Faucet	Toilet, Leakage	Laundry	Toilets	External Only
Annual Market Penetration (%)	1.0% for all accounts per year + all new accounts. Equates to about 4-7% total accounts per year	0.5% for all accounts per year, for a total of 5% by end of program	0.5% of SF accounts per year, for a total of 5% by end of program	1.0% of SF accounts per year, for a total of 10% by end of program	8% of pre-1994 structures	1.0% of SF accounts per year
Percent Reduction in Water Use	varies	10%	10%	40%	varies	10%
Evaluation Start Year	2010	2010	2010	2010	2010	2007
Program Length, years	40	10	10	10	10	40
Measure Life, years	permanent	5	5	permanent	permanent	7
Utility Unit Cost for SF accounts, \$/unit	\$ 150	\$ 25	\$ 5	\$ 150	\$ 150	\$ 75
Utility Unit Cost for MF and COM accounts, \$/unit	\$ 150				\$ 150	
Utility Unit Cost for INS accounts, \$/unit	\$ 150				\$ 150	
Customer Unit Cost. SF accounts \$/unit	\$ 250	\$ 25	\$ 25	\$ 150	\$ 50	\$ 10
Customer Unit Cost. MF-COM accounts, \$/unit	\$ 250				\$ 50	
Customer Unit Cost. INS accounts, \$/unit	\$ 250				\$ 50	
Administration, Mark-up	30%	25%	25%	30%	25%	25%
Comments	Assume savings are 10 gal/day for SFR			Cost assumes no energy company financial involvement	Costs are per toilet; Restricted to replacing toilets that flush with greater than or equal to 3.5 gpf	Assume customer costs are covered by other programs such as toilets, washers, etc

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Washington County Selected Measure Number	W14	W15	W16	W17	W18	W19/34
	Multifamily Water Surveys	Multifamily Washer Rebate	Hot Water on Demand Requirement on New and Rebates for Existing	Multi Family Submetering Requirement on New Accounts	Garbage Disposal Removal SF	Public Education + Demo Gardens
Applicable Customer Classes	MF	MF	New SF	New MF	SF	SF
Applicable End Uses	External Only	Laundry	Faucet and shower end use	ALL Interior	Faucets	ALL
Market Penetration by End Of Program	1.0% of MF accounts per year	30% of Bldgs. With >10 units. Equates to 10% of all MF accounts by end of program.	90% of new accounts	90% of new	1.0% of SF accounts per year, for a total of 10% of accounts by the end of the program	50%
Water Use Reductions For Targeted End Uses	10%	40%	14.2 gpd per du	15%	2 gpd	0.50%
Evaluation Start Year	2010	2010	2010	2010	2010	2007
Program Length, years	40	10	40	40	10	40
Measure Life, years	7	permanent	permanent	permanent	permanent	2
Utility Unit Cost for SF accounts, \$/unit			\$ 50		\$ 100	\$ 2.50
Utility Unit Cost for MF and COM accounts, \$/unit	\$ 150	\$ 400		\$ 50		
Utility Unit Cost for INS accounts, \$/unit						
Customer Unit Cost. SF accounts \$/unit			\$ 500		\$ 50	\$ -
Customer Unit Cost. MF-COM accounts, \$/unit	\$ 50	\$ 200		\$ 2,500		
Customer Unit Cost. INS accounts, \$/unit	-					
Administration, Mark-up	25%	30%	25%	25%	30%	10%
Comments		Assumes an average of 2 machines per MF account				

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Washington County Selected Measure Number	W20	W21	W22	W23	W24	W25
	Adjustment to Conservation Pricing	New Home Award Programs (WaterSense)	Outdoor Use Education & Training Programs	Rotating Sprinkler Nozzle Rebates	CII Surveys	CII Replace Inefficient Equipment
Applicable Customer Classes	SF	New SF	SF	SF, MF, COM, INS	COM,INS	COM,INS
Applicable End Uses	ALL	ALL EXCEPT IRR	Irrigation	Irrigation	ALL EXCEPT IRR	ALL
Annual Market Penetration (%)	100%	50%	0.5% of accounts per year	1% of accounts per year	0.5% of accounts per year	0.3% of accounts per year, for a total of 3% of accounts by end of program
Water Use Reductions For Targeted End Uses	Elasticity's: -0.05 indoor; -0.2 outdoor	10%	10%	5%	10%	15%
Evaluation Start Year	2010	2010	2010	2010	2010	2010
Program Length, years	40	40	40	10	10	10
Measure Life, years	permanent	permanent	permanent	permanent	permanent	permanent
Utility Unit Cost for SF accounts, \$/unit	\$2-5	\$ 50	\$ 1,000	\$ 50		
Utility Unit Cost for MF and COM accounts, \$/unit				\$ 250	\$ 2,000	\$ 1,000
Utility Unit Cost for INS accounts, \$/unit				\$ 500	\$ 2,000	\$ 1,000
Customer Unit Cost. SF accounts \$/unit		\$ 500	\$ 300	\$ 50		
Customer Unit Cost. MF-COM accounts, \$/unit				\$ 250	\$ 2,000	\$ 1,000
Customer Unit Cost. INS accounts, \$/unit				\$ 500	\$ 2,000	\$ 1,000
Administration, Mark-up	10%	30%	30%	25%	25%	30%
Comments	Assume equivalent of 10% price hike every 5 years starting in 2012; Costs are for rate study and extra customer service.	Water Sense for New SF homes only. Exclude Irrigation end use because duplicates existing measure W4.	\$1,000 per class, 4 classes per year.	Assume 330 customers each take 10-15 nozzles for retrofitting one lawn.	10 surveys/yr	6 rebates/yr

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Washington County Selected Measure Number	W26	W27	W28	W29	W30	W31
	Restaurant low flow spray rinse nozzles	Award Programs for Water Savings Businesses	High Efficiency Urinal Rebates	Focused Water Audits for Hotels/Motels	School Building Retrofit	Irrigation Water Surveys
Applicable Customer Classes	COM,INS	COM	COM, INS	COM	INS	INS
Applicable End Uses	Spray Valve end use	ALL EXCEPT IRR	Urinals	Hotel End Use	ALL	Irrigation
Annual Market Penetration (%)	5% of pre-2006 sites/year	0.15% of accounts per year	1% of accounts per year, for a total of 10% by end of program	4 hotels per year, for a total of 40 hotels by end of program	1% of accounts per year for a total of 10% by end of program	5% of large turf areas surveyed/yr
Water Use Reductions For Targeted End Uses	35%	25%	varies	10%	25%	15%
Evaluation Start Year	2010	2010	2010	2010	2010	2010
Program Length, years	5	40	10	10	10	40
Measure Life, years	permanent	permanent	permanent	permanent	permanent	3
Utility Unit Cost for SF accounts, \$/unit						
Utility Unit Cost for MF and COM accounts, \$/unit	\$ 150	\$ 1,000	\$ 200	\$ 1,000		
Utility Unit Cost for INS accounts, \$/unit	\$ 150		\$ 200		\$ 5,000	\$ 1,500
Customer Unit Cost. SF accounts \$/unit						
Customer Unit Cost. MF-COM accounts, \$/unit		\$ 5,000	\$ 400	\$ 2,000		
Customer Unit Cost. INS accounts, \$/unit			\$ 400		\$ 5,000	\$ 1,000
Administration, Mark-up	25%	30%	25%	25%	25%	30%
Comments	100 Restaurants in Wash Co. from the yellow pages	3 large customers participate/yr		Audit 10% of pre-1994 hotels/motels/yr.	Audit 10% of pre-1994 schools/yr. Get no.schools from Julie	Applies to large turf areas only

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Washington County Selected Measure Number	W32	W33	W35	W36	W37
	Artificial Turf Rebate	Require Irrigation Designer/ Installer Certification	Train Landscape Maintenance Workers	Prohibit Ineffiicent Uses in New Accounts	Real Water Loss Reduction
Applicable Customer Classes	INS	New MF, COM, INS	MF, COM, INS	New COM, INS	SYSTEM
Applicable End Uses	Irrigation	Irrigation	Irrigation	Leaks, Cooling, Fountains	UFW
Market Penetration by End Of Program	One 3 acre site/yr	75% of new landscapes	2%/yr	100%	100%
Water Use Reductions For Targeted End Uses	90%	15%	5%	5%	1%
Evaluation Start Year	2010	2010	2010	2010	2010
Program Length, years	10	40	40	40	10
Measure Life, years	permanent	permanent	5	permanent	permanent
Utility Unit Cost for SF accounts, \$/unit			-		
Utility Unit Cost for MF and COM accounts, \$/unit		\$ 100	\$ 100	\$ 25	
Utility Unit Cost for INS accounts, \$/unit	\$ 80,000	\$ 200	\$ 100	\$ 50	
Customer Unit Cost. SF accounts \$/unit			-		
Customer Unit Cost. MF-COM accounts, \$/unit		\$ 500	\$ 100	\$ 100	
Customer Unit Cost. INS accounts, \$/unit	\$ 900,000	\$ 1,000	\$ 100	\$ 200	
Administration, Mark-up	20%	30%	30%	30%	0%
Comments	One rebate per year	St. George starting new program Jan 2010	Educate 50% of contractors over 5 years that affect 2% of accounts/yr	Modify or create new ordinances	Costs \$292k for years 1-3, then \$275k for all years following

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MF

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ND

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