Metropolitan's Conservation Savings Model: Methodology and Assumptions

2015 Integrated Resources Plan Update

Water Use Efficiency Workgroup

DRAFT

4/13/2015

Metropolitan is seeking peer review on the methodology and assumptions used in Metropolitan's Conservation Savings Model. This Technical Memo will serve as the discussion platform for quantifying active and code-based conservation savings in Metropolitan's service area.

Metropolitan Water District of Southern California
Contact Information:
Mike Ti (mike_ti@mwdh2o.com)
Warren Teitz (wteitz@mwdh2o.com)

Metropolitan's Conservation Savings Model

Introduction

Unlike traditional water supplies, which can be directly measured, conservation reduces water demand in ways that are quantified indirectly. Demand is reduced through changes in consumer behavior and savings from water-efficient fixtures, such as toilets and showerheads. There are numerous approaches for estimating and projecting conservation savings, and many of them are utility-specific to meet the unique needs of different water agencies. Metropolitan has developed a Conservation Savings Model (Conservation Model) to estimate savings from the extensive existing conservation programs funded by Metropolitan, as well as those produced by plumbing codes. Metropolitan also incorporates the savings due to the impacts of price on consumers in its demand forecasts. These conservation savings estimates are incorporated into Metropolitan's the long-term planning such as the Integrated Water Resources Plan (IRP). This Technical Memo provides a high-level description of the Conservation Model.

Conservation savings are commonly estimated from a base-year water-use profile. Beginning with the 1996 IRP, Metropolitan identified 1980 as the base year for estimating conservation because it marked the effective date of a new plumbing code in California requiring toilets in new construction to be rated at 3.5 gallons per flush or less. Between 1980 and 1990, Metropolitan's service area saved an estimated 250 TAF per year as the result of this 1980 plumbing code and unrelated water rate increases. Within Metropolitan's planning framework, these savings are referred to as "pre-1990 savings." Pre-1990 savings were estimated for the 1996 IRP and are not a component of the current Conservation Model. Metropolitan's conservation accounting combines pre-1990 savings and estimates of more recently achieved savings.

The Conservation Model accounts for the following sources of conservation:

- Active Conservation – Water saved directly as a result of conservation programs by water agencies, including implementation of Best Management Practices by the California Urban Water Conservation Council (CUWCC). Active conservation is unlikely to occur without agency action.
- Code-Based Conservation – Water saved as a result of changes in water efficiency requirements for plumbing fixtures in plumbing codes. Sometimes referred to as "passive conservation," this form of conservation would occur as a matter for course without any additional action from water agencies.
- Price-effect Conservation – Water saved by retail customers attributable to the effect of changes in the real (inflation-adjusted) price of water. Because water has a positive price elasticity of demand, increases in water price will decrease the quantity demanded.

Metropolitan's Conservation Savings Model

The Conservation Model features a comprehensive representation of Metropolitan's active conservation activities and utilizes a combination of fixture/program savings rates based on CUWCC reports and other sources. It measures active and plumbing code conservation from a 1990 base year. Active and code-based conservation savings are calculated in the Conservation Model described here, while price-effect savings is calculated using the MWD-MAIN. MWD-MAIN is statistical model used for forecasting retail water demands. Potential savings from public outreach and education programs are not accounted for in the Conservation Model.

Methodology

Distinguishing between active, code-based and price-effect conservation can be complex when, for example, active programs for fixtures are concurrent with conservation-related plumbing codes. The Conservation Model combines active, code-based, and price-effect conservation savings using methods that avoid double-counting. The Conservation Model consists of two interrelated models:

1) Active Conservation Model (Active Model) and
2) Code-base Conservation (Code-base Model).

Currently, there are 74 devices and programs represented in the Active Model. These devices are aggregated into residential, landscape, and commercial, industrial, and institutional sectors. Eight of the fixtures are tied to Code-based models. The model is run individually for each of Metropolitan's 26 member agencies. Results are post-processed to the following use categories:

- Single-family residential (SFR),
- Multi-family residential (MFR), and
- Commercial, industrial, and institutional (CII).

Active Conservation

The Active Model estimates savings from conservation programs administered by Metropolitan and its member agencies since 1990. The savings are calculated by combining counts of active program activity – numbers of devices and/or program implementations – with device-related savings factors. The factors include:

- Savings per device/implementation
- Device life expressed in years
- Decay rate expressed as percent decay per year

Active Conservation Assumptions

Device savings estimates are determined by key assumptions described above. These assumptions are shown in appendices A and B. Devices may be represented more than once due to different implementation methods or savings factors. Assumptions are periodically reviewed to ensure they represent the best savings estimates available. In some cases, the sources behind the assumptions are noted.

Active Savings Calculation

Device savings are limited by decay rates, or device life, but not both at the same time. For example, a residential high-efficiency toilet (HET) saves about 38 gallons per day over a lifetime of 20 years with no assumed decay rate. For a complete list of current and past device and program savings factors, see Appendices A and B. Annual savings are expressed in acre-feet (AF).

$$S_i = \frac{d_i * a_i * 365}{325{,}851 \text{ Gallons per AF}}$$

- S_i is the annual savings in acre-feet (AF) for device i.
- d_i is the number of device i installed under an active conservation program.
- a_i is the gallons per day savings from a baseline. Baselines are specific to each device and represent the typical amount of water usage for a conventional device prior to more efficient alternatives being made available, either through plumbing code enforcement or market innovations. For example, a HET with a 1.28 gallons-per-flush (GPF) has a savings factor of 38 gallons per day compared to the 3.5 GPF toilets available before the 1992 plumbing codes.
- 365 is the number of days assumed in one year for the purpose of simplifying the calculation.
- 325,851 is the number of gallons in one acre-foot of water.

Lifetime savings is the sum of annual savings over the life expectancy of the device.

$$L_i = \sum_{t_i=0}^{n} S_i$$

- L_i is the lifetime savings of device i.
- n is the number of years a device is expected to produce savings before it fails. This varies depending on the type of device.
- t is the year when device i is producing savings.
- S_i is the annual savings in acre-feet (AF) for device i.

Code-Based Model

Plumbing code conservation is the impact of plumbing codes and other ordinances on water demand. Metropolitan's Code-based Model represents plumbing code conservation with demographically-driven stock models. The stock models are device- or fixture- specific and are based on the same demographic data used in Metropolitan's retail demand projection. Each stock model tracks the stocks and flows of conserving and non-conserving water devices, allowing it to estimate the impacts of plumbing codes on device saturation and overall savings. The Code-based Model accounts for the following:

- Fixtures from new construction,
- Natural replacement, and
- Code-based devices originated from devices installed through active conservation programs.

New Construction

Water fixtures installed due to new construction are assumed to be in compliance with the plumbing codes in effect when the new construction occurs. For instance, the model would assume a house built in 1997 would meet the efficiency standards set by California's 1992 plumbing code. Therefore, new construction is assumed to result in measurable savings from a non-efficient baseline. The Code-Based model uses 1990 as the baseline. Estimates and projections of the number of fixtures added through new housing units and offices is based on growth in housing units or employment. The following equation calculates the number of fixtures installed each year from new residential construction.

$$N_{nc} = \left(h_{y+1} - h_y\right) * \; b_h * \; c_p$$

- N_{nc} is the number of fixtures installed from new construction.
- h_y is the number of households for year y. This is used to measure housing growth from new construction from year to year.
- b_h is the number of fixtures per household based on averages developed from single-family and multi-family housing units (e.g. 2 toilets per household).
- c_p is the plumbing code compliance rate. The compliance rate increases over time as the conventional fixtures are phased out and replaced in the market.

Natural Replacement

Natural replacement accounts for the savings that accrue when fixtures are replaced with more efficient models due to remodeling, failure or other reasons. The Code-Based model represents this effect with a "natural replacement rate" that is expressed as a percentage of existing fixtures that are replaced in a given year. Natural replacement rates vary by device and are linked to the expected life of the device. Devices with short lifespans will be replaced more frequently and thus have higher natural replacement rates. A simple percentage is used to account for this natural turn-over in non-conserving fixtures because it is difficult to back-calculate the age of the fixtures in pre-1990 construction. Metropolitan's model assumes that two percent of all non-efficient toilets in the residential sector are retrofitted due to natural replacement in any given year. The new toilets are assumed to meet the efficiency standards in effect at the time of the retrofit. For instance, a residence that retrofitted a broken toilet in 1997 is assumed to have replaced it with a 1.6 GPF toilet required by the 1992 plumbing code. The following formula represents this mathematically.

$$N_{nr} = (d_{nc} - \; d_c) * \; r_{nr} * \; c_{nr}$$

- N_{nr} is the number of fixtures installed from natural replacement.
- d_{nc} is the number of non-conserving or conventional fixtures.
- d_c is the number of conserving or water-efficient fixtures that are installed through conservation programs administered by water agencies.
- r_{nr} is the natural replacement rate of fixtures that are replaced with more efficient models due to remodeling or failure. For example, the CUWCC and other agencies use a four percent natural replacement rate for toilets. Metropolitan uses a lower rate of two percent to account

for possible double-counting of ultra-low flush toilet rebates during the 1990s due to free-ridership.

- c_{nr} is the compliance rate for natural replacement. During the early phase-in period of plumbing code, it is presumed that consumers still have a choice between conserving fixtures that conform to the new plumbing code or the conventional fixtures. The compliance rate increases over time as the conventional fixtures are phased out and replaced in the market.

Customers who receive or take advantage of active conservation incentives to fund device retrofits they would have performed anyway (due to failure, remodeling or for other reasons) are known as "free-riders. While the model has the ability to account for free-ridership, this feature is not used by Metropolitan.

Fixtures Up for Renewal

As water-conserving fixtures reach their useful lives and became defective or inefficient, they may be replaced with water conserving fixtures due to by plumbing codes. The water savings from the device is then considered "renewed" in the Conservation Model and the renewed savings is tracked. For example, a fixture that was installed through an active conservation program provides water savings that otherwise would not have been realized without plumbing codes. However, subsequent adoption of efficient plumbing codes means that when the fixture reaches the end of its life it will be replaced by the same or more water-efficient model. Fixtures up for renewal are calculated as follows:

$$N_{ur} = d_a + d_c$$

- N_{ur} is the number of fixtures up for renewal as they reach their useful lives.
- d_a is the number fixtures installed through conservation programs that have reached their useful lives and are being replaced by the same water-efficient models or better.
- d_c is the number of fixtures that were replaced due to plumbing codes that have reached their useful lives and are being replaced by the same water-efficient models or better.

Stock Models

The number of efficient fixtures for each stock model is the sum of fixtures from active programs (N_{ap}), new construction, natural replacement, and fixtures up for renewal.

$$N = N_{ap} + N_{nc} + N_{nr} + N_{ur}$$

The following fixtures and devices are assigned stock models based on existing plumbing codes:

Residential	CII
Toilets	Toilets
Showerheads	Urinals
Faucet Aerators	Pre-Rinse Spray Heads
Washing Machines	Washing Machines

The Stock Models generate annual estimates of devices and fixtures that are fed into the Active Model's water savings calculations and tracked separately. The Stock Models also account for the impacts of active programs on the overall device saturation rate. As a result, increased levels of active conservation lead to lower levels of plumbing code conservation. This helps avoid double-counting conservation savings in the model.

Plumbing Code Assumptions

Plumbing code savings are determined by the device-specific assumptions used in the stock models. The stock models are driven by projections of housing and employment described earlier in this memo, so they are consistent with the demand projections. Initial device counts and growth in the number of devices are determined by the demographics combined with the assumptions described below:

- Devices per Household or Per Employee: This factor represents the average number of devices per household or per employee and is multiplied by the demographic projections to develop estimates of total number of devices or "stock." Devices per household and employee can vary by agency and change over time.
- Plumbing Code Compliance Rate: The plumbing code compliance rate is expressed as a percent and serves two purposes: (1) it indicates the presence of a plumbing code in a specific year, and (2) determines the overall compliance rate with the plumbing code. This allows plumbing code effects to be phased in over several years.
- Natural Replacement Rate: This represents the rate at which existing non-conserving devices are converted to conserving devices due to remodeling or device failure. It has a strong impact on the saturation rate of devices that existed prior to plumbing codes, such as pre-1992 toilets.
- Device Life: The stock models also account for device life for water-efficient devices installed after 1990. This allows the stock model to track devices installed through active conservation as they reach the end of their life and are replaced due to plumbing codes. The stock models use the same device life specified in the savings assumptions.

Plumbing code assumptions:

Stock Model	Device per Household/ Employee	Compliance Rate	Natural Replacement Rate	Plumbing Code Year
Res. Toilets	2	99%	2%	1992
Res. Shower Heads	1.8	95%	10%	1992
Res. Aerators	3.5	90%	33%	1992
Res. Washing Machine	0.74	100%	6.7%	2007
CII Toilets	0.27*	100%	2%	1992
CII Urinals	0.06	100%	4%	1992
CII Pre-Rinse Spray Heads	0.0055*	95%	16.7%	2006
CII Washing Machine	0.0073*	100%	5%	2007

* Varies overtime and by agency (based on CUWCC BMP savings factors)

These assumptions are derived from CUWCC conservation reports, American Water Works Association Research Foundation (AWWARF)'s 1999 end use study, Metropolitan's Orange County Saturation Study, IWR-MAIN conservation assumptions, and other sources. In the residential sector, devices per household combine single family and multifamily trends. [NEED TO LOCATE AND CITE THE SOURCES]

Price Savings Assumptions

Price-effect savings are calculated by comparing MWD-MAIN's demand projections with price increases to demand projections with constant 1990 water rates. The difference is the price-effect savings measured from a 1990 base. Price-effect savings increase as prices rise over time; they also increase as the household and employment base grow. A price increase applied to 1,000 households will generate more water savings than the same price increase applied to 500 households.

Un-metered Water Use Savings

A final category of savings tracked by Metropolitan is a product other conservation efforts. MWD-MAIN projects un-metered water use as a fixed percentage of total retail M&I demand. As conservation savings lowers residential and CII demands, it lowers un-metered use by the same percent. For instance, if conservation reduces M&I demands by 10 percent in 2020 (compared to demands before conservation) un-metered water use is also reduced 10 percent. This reduction is based on the assumption that un-metered use varies according to overall demand and that reducing overall use also reduces un-metered use. The reduction in un-metered water use is captured in the MWD-MAIN model and included as a conservation source.

Appendix A: Current Program/Device Factors

Current Program/Device	Gallons per Day	Acre-feet per Year	Days per Year	Device Life (Yrs)	Device Decay (%/Yr)	Source or Justification
CII						
Agricultural Conservation	89.2742	0.100	365	10		Board Ltr 8-7, May 2010; Lifetime savings inputted into WINS, incentive is $195/af up to 50% of all equip
Connectionless Food Steamer	223.290	0.250	365	10		Bd Ltr 8-8, dated Dec. 13, 2005 - 81,500 gal/yr for 10 years
Cooling Tower Cond Meter	803.500	0.641	260	5		Bd Ltr. 7-7 Aug 1997. Assumes office building, open 5 days per week - 3.2 AF lifetime savings
Dry Vacuum Pump	120.000	0.092	260	7		Bd. Ltr. 8-4, July 2007 - 30,000 gpy per .5 HP & 7 yr life
HET - Melded Rate	21.880	0.025	365	20		
Ice Machine	137.500	0.154	365	10		
In-Stem Flow Regulator	2.678	0.003	365	5		Board Ltr 8-4, May 2012
Laminar Flow Restrictor	20.979	0.024	365	5		Board Ltr 8-4, May 2012
PH Cooling Tower Controller	2,435.856	1.943	260	5		Bd Ltr 8-8, Dec 2005. Assumes office bldng, 5 days/week. 844,430 gpy * 75% (to adjust for behavior)
Plumbing Flow Control	7.499	0.008	365	10		
Pre-Rinse Spray Head	136.610	0.153	365	5		Bd. Ltr. 7-7, August 1997 - Savings from CUWCC study; 50,000 gpy savings & 5 yr life
Rotating Nozzles	3.570	0.004	365	5		Bd. Ltr. 7-5, dated August 2006 - 6,600 gal life savings per nozzle & 5 yr life
Soil Moisture Sensor	11.520	0.013	365	10		
Steam Sterilizer	1,160.740	1.300	365	15		Bd. Ltr. 7-5, August 15, 2006 - 1.3 afy & 15 yr life
Turf Removal	0.121	0.000	365	10		Bd. Ltr. 8-2, November 18, 2008; 44 gal/yr per sq. ft.
WBIC by Station	11.520	0.013	365	10		
Weather-Based Controller	290.000	0.325	365	10		Bd Ltr 8-8, dated Sep 14, 2004
Zero Water Urinal	109.590	0.123	365	20		Bd Ltr 8-8, dated Dec 13, 2005 - 40,000 gpy & 20 yr life
Landscape						
Audits	8,931.507	0.550	365	2		Bd. Ltr. 7-5, August 2006
Large Rotors - HE Nozzles	16.000	0.018	365	10		Bd. Ltr. 8-4, July 2007 - .18 AF life savings & 10 yr life
Synthetic Turf	0.125	0.000	365	10		Bd. Ltr. 8-4, July 2007 - 6 AFY savings on athletic fields & 10 yr life
Water Use Accountability	14.910	0.008	365	1		Bd. Ltr. 8-8, September 2004; 0.1 per year divided by 12 to account for monthly billing. 5-yr program with 1-yr life to capture annual activities over the course of the program.
Weather-Based Controllers	290.000	0.325	365	10		Bd Ltr 8-8, dated Sep 14, 2004
Residential						
H-E Clothes Washer (WF 4)	29.320	0.033	365	14		

Current Program/Device	Gallons per Day	Acre-feet per Year	Days per Year	Device Life (Yrs)	Device Decay (%/Yr)	Source or Justification
HET - Melded Rate	21.880	0.025	365	20		
Irrigation Evaluation with Timers	25.900	0.029	365	4	0.6	Bd. Ltr. 7-4, March 1996; CUWCC guidelines give 25.9 gpd for turf audit + 60% decay.
Irrigation Evaluation without Timers	12.200	0.014	365	4	0.6	Bd. Ltr. 7-4, March 1996; CUWCC guidelines give 12.2 gpd for turf audits without timers + 60% decay.
Multi-Family Premium HET (Melded Rate)	33.390	0.037	365	20		
Rain Barrel	1.700	0.002	365	5		
Rotating Nozzles	3.570	0.004	365	5		Bd. Ltr. 7-5, dated August 2006 - 6,600 gal life savings per nozzle & 5 yr life
Showerheads	5.500	0.006	365	5	0	Bd. Ltr. 7-4, March 1996; CUWCC gives 20-30% decay rate for showerheads.
Soil Moisture Sensor	36.990	0.041	365	10		
Surveys, Single Family	21.000	0.024	365	5	0.3	Bd. Ltr. 7-4, March 1996; CUWCC gives 21 gpd for untargeted intensive home surveys.
Turf Removal	0.121	0.000	365	10		Bd. Ltr. 8-2, November 18, 2008; 44 gal/yr per sq. ft.
WBIC Large Site (Station)	11.520	0.013	365	10		
Weather-Based Controller	36.986	0.041	365	10		Bd Ltr. 8-5, dated Aug. 20, 2002 - 13,500 gpy savings & 10 yr life

Appendix B: Past Program/Device Factors

Past Program/Device	Gallons per Day	Acre-feet per Year	Days per Year	Device Life (Yrs)	Device Decay (%/Yr)	Source or Justification
CII						
Analyst Survey I	2,947.397	3.300	365	1	0	Based on data from 900 surveys conducted by MWD
Analyst Survey II	2,947.397	3.300	365	1	0	Based on data from 900 surveys conducted by MWD
Engineer Survey	6,609.315	7.400	365	1	0	Based on data from 900 surveys conducted by Metropolitan
Flush Valve Kit	31.346	0.035	365	5	0	Bd. Ltr. 7-7, August 1997
HE Urinal – Upgrade	13.700	0.015	365	20		Bd. Ltr 7-5, August 2006 - 100,000 gal life savings & 20 yr life
HET – Upgrade	7.000	0.008	365	20		Bd Ltr 8-8, dated Dec. 13, 2005 - 7 gpd savings & 20 yr life
High-Efficiency Toilet	38.000	0.043	365	20		Bd Ltr 8-8, dated Dec. 13, 2005 - 38 gpd savings & 20 yr life
High-Efficiency Urinal	54.794	0.061	365	20		Bd Ltr 8-8, dated Dec. 13, 2005 - 20,000 gpy savings & 20 yr life
High-Efficiency Washers	96.000	0.108	365	10	0	Bd. Ltr. 7-7, August 1997 - 16 gal per load * 6 loads/day * 365 days
Industrial Process Improve	178.575	0.100	365	10	0	Bd. Ltr. 7-7, August 1997 & Bd. Ltr. 8-10, June 2004; adjusted to pay on water saved for 10 yrs
Recycled Water Hook-Up	892.876	1.000	365	25		Bd. Ltr. 8-9, August 21, 2007 - $500/af for first year use
ULF Toilets - Dual Flush	40.044	0.045	365	20	0	Bd. Ltr. 8-5, August 2002 - 2,250 gpy additional savings over ULFT & 20 yr life
ULF Toilets - Flush Valve	33.854	0.038	365	20	0	Bd. Ltr. 7-7, August 1997
ULF Toilets - Tank Type	33.854	0.038	365	20	0	Bd. Ltr. 7-7, August 1997
ULF Urinals	38.390	0.043	365	20	0	Bd. Ltr. 7-7, August 1997
Water Broom	191.838	0.153	260	5	0	Bd. Ltr. 8-5, August 2002 - 50,000 gpy, 5 yr life & 5 days/wk
Water Management Study	90,402.308	72.100	260	1	0	Based on data from 900 surveys conducted by Metropolitan
X-Ray Processor	2,858.082	3.200	365	5	0	Bd. Ltr. 8-5, August 2002 - 3.2 AFY savings, 5 yr life, & hospital open 7 days a week.
Zero Water Urinal -Upgrade	27.400	0.031	365	20		Bd. Ltr. 7-5, August 2006 - 200,000 gal life saving & 20 yr life
Landscape						
California-Friendly Landscape	0.088	0.000	365	10		Savings factors provided by Carlos Michelon
Central Controllers	290.000	0.325	365	10	0	Based on water savings achieved from weather based controllers
ET Controllers	36.986	0.041	365	10	0	Bd. Ltr. 8-5, August 2002 - 13,500 gpy & 10 yr life
Residential						
Aerators	1.500	0.002	365	2	0	Bd. Ltr. 7-4, March 1996; CUWCC guidelines, p. 2-20.
Flappers Replaced w/Survey	8.000	0.009	365	5	0	Bd. Ltr. 7-4, March 1996
H-E Clothes Washer (WF 5)	27.945	0.031	365	14		Bd. Ltr. 8-7, March 13, 2007 - 10,200 gpy
H-E Clothes Washer (WF 6)	24.658	0.028	365	14		Bd Ltr 9-10, dated Nov 9, 2004 - 9,000 gpy

Past Program/Device	Gallons per Day	Acre-feet per Year	Days per Year	Device Life (Yrs)	Device Decay (%/Yr)	Source or Justification
HET – Upgrade	7.000	0.008	365	20		Bd Ltr 8-8, dated Dec. 13, 2005 - 7 gpd savings & 20 yr life
High-Efficiency Toilet	38.000	0.043	365	20		Bd Ltr 8-8, dated Dec. 13, 2005 - 38 gpd savings & 20 yr life
High-Efficiency Washers	13.973	0.016	365	14	0	Bd. Ltr. 8-8, January 26, 1999 - ~100 gal/week
Moisture Sensor (Station)	11.520	0.013	365	10		
Multi-Family Surveys	8.800	0.010	365	4	0.3	Assume same as SF indoor survey - 12.2
Showerheads - Distributed	5.500	0.006	365	5	0	Bd. Ltr. 7-4, March 1996; Daily savings reduced to account for .55 installation probability.
Surveys, Single Family-Old	21.000	0.024	365	5	0.3	Bd. Ltr. 7-4, March 1996
Toilet Displacement	4.000	0.004	365	5	0.6	Bd. Ltr. 7-4, March 1996; CUWCC gives 60% decay rate.
ULF Toilets - Distribution	31.280	0.035	365	20	0	Bd. Ltr. 9-9, March 1992 - Weighted regional avg; 60% SF (34 gpd), 40% MF (27 gpd)
ULF Toilets - Rebate	31.100	0.035	365	20	0	Bd. Ltr. 9-9, March 1992; Weighted regional avg; 60% SF (34 gpd), 40% MF (27 gpd)
ULFT - Dual Flush Upgrade	6.164	0.007	365	20		Bd Ltr. 8-5, dated Aug. 20, 2002 - 2,250 gpy savings & 20 yr life
ULFT Toilets - Dual Flush	37.264	0.042	365	20		Bd Ltr. 8-5, dated Aug. 20, 2002 - 2,250 gpy additional savings over ULFT & 20 yr life
WBIC for Large Residential	290.185	0.325	365	10		Bd. Ltr. 8-8, December 2005

Appendix C: Justification for Device Savings Factor

[INCOMPLETE LIST]

Dual-Flush Toilets: (Discontinued Incentive)

A dual-flush toilet operates at 1.6 gallons per flush for solids and 0.8 gallons per flush for liquids. This type of water-efficient toilet is common in other countries and recently was approved for sale in the United States. There have been three recent studies done to determine the additional water savings that can be achieved with dual-flush toilets compared to standard 1.6 ultra-low-flush toilets (ULFTs). All three studies had similar results, with the average additional water savings for dual-flush toilets measured at 2,250 gallons per year per toilet. These water savings are in addition to the existing authorized $60 per unit incentive for ULFTs. The additional water savings of 2,250 gallons per year per toilet, along with an estimated 20-year life and at the Metropolitan incentive level of $154/AF of water saved, would warrant a $20.02 incentive level. The additional incentive is recommended at $20 per unit. The current incentive of $60 per ULFT, along with the recommended additional $20 incentive for dual-flush toilets, brings the total dual-flush incentive to $80 per unit. Dual-flush toilets, on average, cost $200 per unit.

Source: Metropolitan Water District, August 20, 2002 Board Letter 8-5 Attachment 1

Evapotranspiration (ET) Landscape Irrigation Controllers: (Discontinued Incentive)

This high-technology residential irrigation controller connects the real-time information collected by weather stations and sensors to accurately provide irrigation control on the ground. Each electronic controller contains extensive information on soil types, landscape slopes, plant materials, and sprinkler application rates. This allows the controller to apply the irrigation water required to make up for lost ET (the rate at which plants lose water through evaporation and transpiration) while minimizing losses due to runoff. Metropolitan, in cooperation with Municipal Water District of Orange County (MWDOC) and Irvine Ranch Water District, completed a pilot project at 33 single-family homes. The study found average water savings of 13,500 gallons per year per location. These savings along with an estimated ten-year life and at the Metropolitan incentive level of $154/AF of water saved, could warrant an incentive level of $63 per device. The average cost of an ET Controller is approximately $250. The incentive level is recommended at $65 per unit. The focus will be improved irrigation efficiency at the residential level. Metropolitan already has a program to address irrigation controllers for large commercial landscapes.

Source: Metropolitan Water District, August 20, 2002 Board Letter 8-5 Attachment 1

Hospital X-Ray Film Processor Recirculating System: (Discontinued Incentive)

Hospital X-Ray Film Processor Recirculating System was tested through the Innovative Conservation Program (ICP). Existing x-ray processing systems in hospitals consume extremely large amounts of water and are very inefficient in their film washing process. These systems are once-through flow technology. The new recirculating system utilizes a reservoir, treatment and pump system to re-use the water.

Through the ICP, thirty-eight systems were installed and tested in seven major southern California hospitals. Annual water savings averaged 3.2 acre-feet per year per system. These savings, along with an estimated five-year life and at the Metropolitan incentive level of $154/AF of water saved, could warrant an incentive of $2,464 per device. However, with the average cost of the x-ray film processing recirculating system at approximately $4,000 the incentive level is recommended at half the cost or $2,000 per unit. Qualifying devices will be based on size, operating hours and equipment use to ensure compatibility with projected water savings for existing x-ray systems.

Source: Metropolitan Water District, August 20, 2002 Board Letter 8-5 Attachment 1

Water Pressurized Broom: (Discontinued Incentive)

Tested through the ICP. This device replaces traditional hose nozzles used to clean large hardscape surface areas at commercial and industrial facilities such as restaurants, hotels, office buildings and convention centers. It uses a series of small-nozzles to direct multiple high-intensity water sprays in front of the .broom.. Through the ICP, twelve locations were selected within the City of Anaheim to test this technology. Annual savings per pressurized water broom averaged 60 percent or approximately 50,000 gallons per year per location. These savings along with an estimated five-year life and at the Metropolitan incentive level of $154 per acre-foot (AF) of water saved, could warrant an incentive of $117 per device. However, with the average cost of the water pressurized broom technology at approximately $200, the incentive level is recommended at half the cost or $100 per unit.

Source: Metropolitan Water District, August 20, 2002 Board Letter 8-5 Attachment 1

Steam Sterilizer Retrofits (New incentive)

Steam sterilizers are commonly used in hospitals and research laboratories to clean and disinfect surgical equipment, tools and supplies. Most sterilizers are used only intermittently; however, potable water is used continuously to flush sterilizer equipment whether or not the unit is in use. New retrofit devices are capable of mixing potable water with heated condensate discharge only when the sterilizer is in use, thereby saving significant amounts of water. Based on data obtained from several medical facility installations, water savings for a steam sterilizer retrofit are about 1.3 AF per year per unit. There are an estimated 4,200 sterilizers in Southern California. The retrofit devices have a life expectancy of 15 years and cost $1,900. The water savings value exceeds the device cost (1.3 AF/yr x 15 years x $195/AF = $3,800). The recommended incentive is $1,900 (100 percent of device cost).

Source: Metropolitan Water District, August 15, 2006 Board Letter 7-5 Attachment 1

Zero Water and High-Efficiency Urinal Upgrades (Upgraded incentive)

Incentives for zero-water urinals (ZWU) and high-efficiency urinals (HEU) were previously approved for the retrofit of high volume urinals (3.5 gallons per flush or more). These highly efficient urinals also exceed the one-gallon per flush efficiency standards in current plumbing codes for new construction. The proposed incentives will encourage existing retrofits and builders of new construction to upgrade their product choices to these more efficient ZWUs and HEUs. Compared to one-gallon per flush urinals, ZWUs and HEUs save 200,000 and 100,000 gallons, respectively, over their expected 20-year lives. The proposed incentive for ZWUs is: (200,000 gallons/325,900 gallons per AF) x ($195/AF) = $120. HEUs, which save one-half of ZWUs, have a recommended incentive of $60. ZWUs and HEUs cost between $300 and $400. The proposed incentives are less than 100 percent of the device cost.

Source: Metropolitan Water District, August 15, 2006 Board Letter 7-5 Attachment 1

Rotating Nozzles for Pop-Up Spray Head Retrofits (New incentive)

Pop-up spray heads with multi-stream, multi-trajectory rotating nozzles represent a new alternative to the irrigation of landscapes. Field tests demonstrate these devices apply water more evenly than traditional nozzles with fixed conical spray patterns, offering the potential for significant water savings. The new nozzles improve water distribution by about 23 percent on average and reduce irrigation run times by 22 percent, resulting in water savings of 6,600 gallons (0.02 AF) per nozzle over a five-year period. Low precipitation rates associated with these nozzles can reduce run-off and related pollution, thereby offering a significant value-added benefit when irrigating sloping landscapes. The proposed incentive is $4.00 per nozzle (0.02 AF x $195/AF), which is less than 100% of the nozzle cost ($7.50 - $8.00, depending on type). The incentives would be available for both retrofit and new construction in both residential and commercial sectors. Only specialized irrigation equipment supply outlets sell these nozzles. Staff is exploring options to provide the incentive through these supply outlets to directly influence professional irrigation contractors' purchase decisions.

Source: Metropolitan Water District, August 15, 2006 Board Letter 7-5 Attachment 1

Landscape Survey Program (New incentive)

Landscape surveys have been performed by local agencies for many years, but until recently there has been little data to verify water savings and persistence. Landscape surveys typically include an irrigation system evaluation (system performance measurement, identification of needed repairs, recommended upgrades, etc.), development of water budgets and irrigation schedules, and survey report. A water budget is the calculated amount of water a landscape should require to efficiently maintain its health. Staff proposes that Metropolitan also provide incentives for surveys of commercial landscapes with dedicated landscape meters. Based on data from about 450 commercial sites with dedicated meters in ∗ Programs 4 and 6 are mutually exclusive, unless otherwise pre-approved, and no single project or metered parcel can participate in both programs. San Diego County, 180,000 gallons (0.55 AF) were saved per acre per year with a two-year period of persistency, resulting in a lifetime savings of 360,000 gallons (1.1 AF). The incentive would be $215 per acre surveyed (1.1 AF x $195/AF) up to one-half program cost. Program participants will be required to provide actual pre- and post-survey water use data. Staff will periodically analyze this data to recommend adjustments to the incentive level of the program based on ongoing performance.

Source: Metropolitan Water District, Board Letter 8-8, Attachment 2, December 13, 2005

New Incentives for High-Efficiency Toilets

The High-Efficiency Toilet (HET) is defined as a fixture that flushes at 20 percent below an ULFT, equating to a maximum of 1.28 gallons per flush. The average water savings for HETs is estimated to be 38 gallons per day (gpd) when replacing an average non-efficient toilet and 7 gpd when replacing a ULFT. The savings are estimated to persist for 20 years based on industry standard device life. The incentive is for the installation of both the bowl and the tank, or flush valve where appropriate.

Source: Metropolitan Water District, Board Letter 8-8, Attachment 2, December 13, 2005

Urinal Rebates

Metropolitan currently pays $60 per conserving urinal installed, with water use of one gallon per flush or less. Staff recommends, starting July 1, 2006, Metropolitan no longer funds standard urinals, and fund only zero water urinals and high-efficiency urinals (HEU).[2]

- Zero water urinals – Zero water urinals are urinals that use technologies, such as a cartridge or a sealant, rather than water to eliminate liquid waste. Based on data from studies of actual usage in several locations, these urinals save an average of 40,000 gallons per year with an estimated 20-year life. The incentive is for a retrofit of the fixture. For new construction, water savings would be less since code requires a 1.0 gpf urinal. Savings would be approximately 11,500 gallons per year over a 20-year life.
- High-efficiency urinals – HEUs are urinals that use 0.5 gallons per flush or less. Based on data from studies of actual usage, these urinals save 20,000 gallons per year with an estimated 20-year life. The incentive is for a retrofit of the fixture and is not for new construction.

pH Cooling Tower Conductivity Controllers

Commercial buildings often use cooling towers, which use water to dissipate heat, as a means of climate control. The pH cooling tower conductivity controllers continuously monitor and automatically maintain pH levels of recirculated water by activating either an acid or base chemical feed. Based on data from the Los Angeles Department of Water and Power’s Technical Assistance Program, these controllers save an average of 844,430 gallons per year with an estimated five-year life. Adjusting for behavioral factors, it is recommended to use 75 percent of estimated water savings potential to establish a device incentive.

Source: Metropolitan Water District, Board Letter 8-8, Attachment 2, December 13, 2005

Connectionless Food Steamers

Restaurants often use food steamers to maintain or warm food. Recently, new water-efficient connectionless food steamers, which have no water line or sewer discharge line, have been developed. This type of food steamer is intended for small- to medium-size restaurants. Metropolitan has identified ten manufacturers of connectionless food steamers. Based on data from a study done by the Food Service Technology Center, the connectionless steamers save an average of 81,500 gallons per year with an estimated ten-year life.

Source: Metropolitan Water District, Board Letter 8-8, Attachment 2, December 13, 2005