WATER USE EFFICIENCY

STRATEGIC PLAN

Phase 1

Urban Conservation Programs
for Long-Term Conservation
and Shortage Management

Santa Clara Valley Water District SM

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Mission

The mission of the District is a healthy, safe, and enhanced quality of living in Santa Clara County through watershed stewardship and comprehensive management of water resources in a practical, cost-effective, and environmentally sensitive manner.

Board of Directors

From left to right: Richard P. Santos, District 3; Joe Judge, District 2; Rosemary Kamei - Chair, District 1; Tony Estremera, At Large; Sig Sanchez - Vice-Chair, At-Large; Patrick Kwok, District 5; Larry Wilson, District 4

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Executive Summary

Strategic Plan Objectives and Phasing

The District's Water Use Efficiency (WUE) Program, which includes water conservation, water recycling, and desalination programs, reduces demand on existing imported and local water supplies and assist in meeting the District Board's Ends Policies for water supply reliability, water conservation, and water recycling. These policies, in conjunction with the District's 2003 Integrated Water Resources Planning Study (IWRP 2003) and the 2005 Urban Water Management Plan (UWMP 2005), require that:

In addition to these broad policy objectives, the District has established the following numeric targets for recycled water and conservation:

- Water recycling is to reach 5 percent of total water use or 19,100 acre-feet by 2010 and 10 percent or 40,500 acre-feet by 2020.
- Water conservation is to achieve 98,500 acre-feet of water savings by 2030, consisting of:
  - 70,500 acre-feet from implementation of Best Management Practices (BMPs) and water use efficiency code requirements.[1]
  - 28,000 acre-feet above and beyond water savings from BMPs and water use efficiency code requirements, per the IWRP Study 2003 identification of "No Regrets" near-term reliability investments.

The Water Use Efficiency Strategic Plan (hereafter Strategic Plan) is intended to provide a blueprint for meeting these policy objectives and targets. Its purpose is to evaluate and recommend WUE measures for meeting District policy objectives and targets for water conservation, water recycling, and desalination; develop schedules for implementation; estimate costs; and identify protocols for monitoring and evaluating program performance over time. The plan will also aid the District in its response to the Governor's call to achieve a 20 percent reduction in per capita water use statewide by 2020. Additionally, it will provide the blue print for ensuring compliance with AB 1420 Demand Management Measure (DMM) implementation requirements for accessing state funding programs for urban conservation.

The Strategic Plan is being developed in two phases. Policies and measures for long-term water conservation and water shortage management are addressed in this, the Phase 1, report. Water recycling and desalination will be addressed in the Phase 2 report.

1 The Strategic Plan's analysis of BMP implementation and water savings is based on BMP definitions and requirements as of July 2008.

Phase 1 of the Strategic Plan contains the following information:

- An overview of District water supplies, water demands, system characteristics, and water supply reliability, including near-term risks to the District's imported water supply and the potential for near-term water shortages.
- A review of the District's long-term water conservation policies, CEO Interpretations, and targets and shortage management policies.
- An overview of District conservation programs to date, including updated forecasts of water savings from past program implementation and the enactment of water use efficiency codes, and the need for additional conservation measures to achieve District long-term conservation targets.
- A least-cost plan for achieving the District's long-term conservation targets, including level of program implementation, program schedule, estimated costs of proposed programs, and compliance with the Memorandum of Understanding Regarding Urban Water Conservation in California.
- An assessment of conservation programs and demand management policies/ strategies for temporary water shortages lasting up to three years, including estimated water savings potential, and expected costs to the District.
- A plan for monitoring and evaluating conservation program effectiveness, water savings, and costs, and adjusting implementation of conservation programs accordingly.

Immediate and Long-Term Water Supply Challenges

In an average year, about half of Santa Clara County's water is drawn from local groundwater aquifers or rainwater captured in the district's reservoirs. The balance originates hundreds of miles away - first as snow in the Sierra Nevada range of northern and eastern California, then as river water that empties into the Sacramento-San Joaquin River Delta. This imported water is brought into Santa Clara County through the State Water Project (SWP), the federal Central Valley Project (CVP), and San Francisco's Hetch Hetchy system. While the county's imported water supply has always been variable due to vagaries in weather and precipitation, recent decisions affecting current operations of CVP and SWP Delta facilities as well as long-term threats to these systems due to climate change and Delta levee fragility pose significant risks to the reliability of the county's imported water supply.

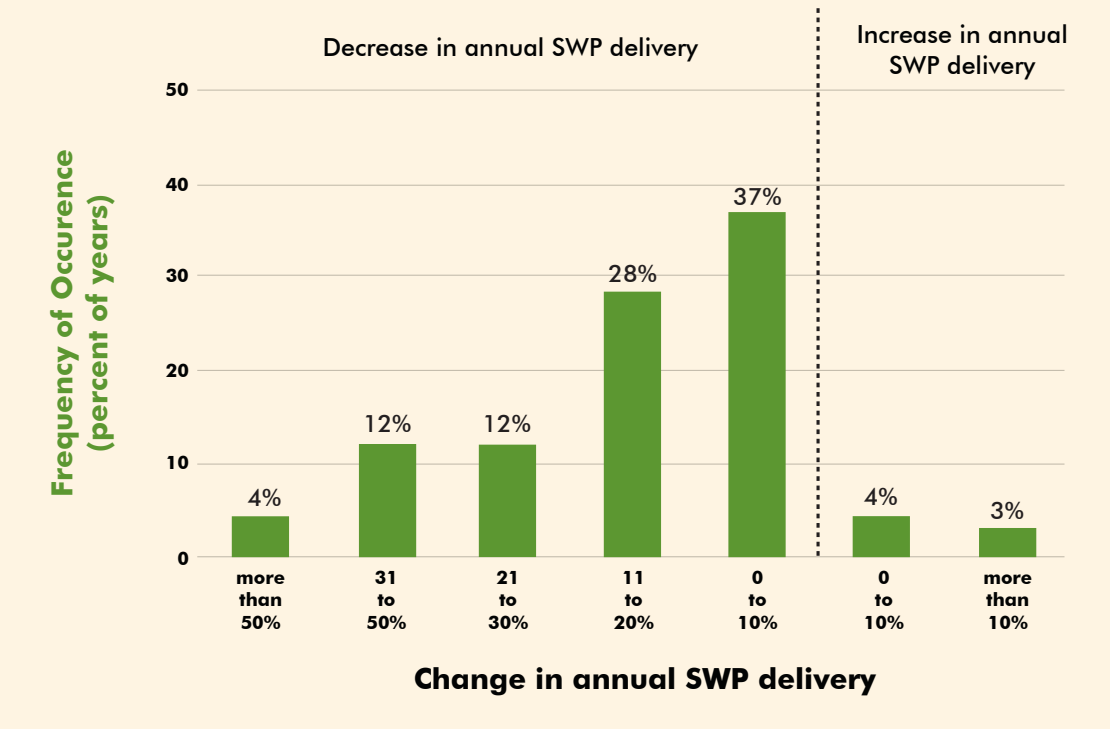
In December 2007, a federal court imposed interim rules that will significantly restrict the operations of both the SWP and the CVP while a new federal biological opinion for Delta smelt is written in 2008. Specific pumping constraints in 2008 are dependent upon the behavior of the delta smelt and are therefore impossible to predict precisely. Preliminary modeling by the District has indicated that under median year hydrologic conditions Delta Smelt Interim Remedy actions could reduce the District's combined CVP and SWP supplies by 5 to 20 percent, while under dry year conditions, supplies could be reduced by 2 to 24 percent.[2]

2 Board Agenda Memo, 2008 Water Supply Operations and Contingency Strategy, December 18, 2007.

Figure ES1 shows DWR's current estimate of how the court decision is expected to impact SWP deliveries over the next several years. Under the interim rules, SWP deliveries are expected to decrease 93 percent of the time, with an average decrease of approximately 15.6 percent. Impacts on CVP Delta exports are expected to be of similar magnitude.

Although the interim rules apply only while the new federal biological opinion for Delta smelt is being written, the new opinion may similarly impact the reliability of SWP and CVP exports. Moreover, recent sharp declines in other pelagic and salmonid fish populations in the Delta may result in further restrictions on water exports. Thus, Santa Clara County potentially faces the immediate and continuing loss of between 10 and 20 percent of its water supply in average water years because of more stringent regulations in the Delta. This water would need to be replaced by other sources of supply (e.g. local groundwater reserves, Semitropic banked groundwater) and demand management.

Figure ES1. Impact of Federal Court Order on SWP Deliveries



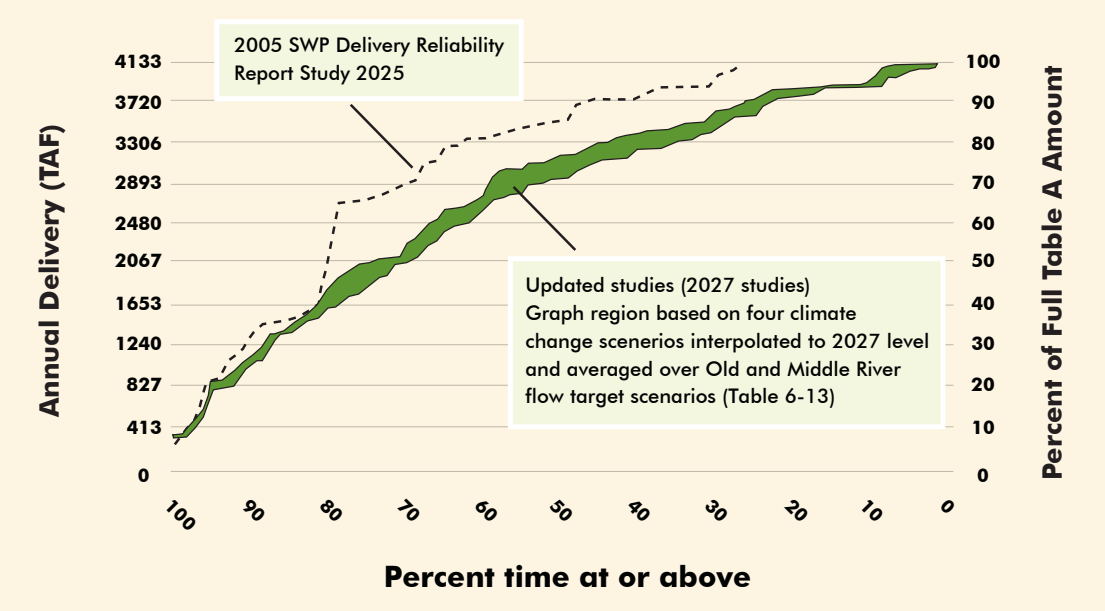
In addition to these immediate threats to its imported water supply, the District confronts a number of long-term risks to water supply reliability. New information on potential changes to the state's water supply as a consequence of climate change as well as a better understanding of the vulnerability of Delta levees to flood and seismic events has led to DWR substantially reducing its long-term SWP reliability forecast. Additionally, resolution of OCAP salmonid litigation may result in additional Delta pumping restrictions. As shown in Figure ES2, under the new

forecast the long-term delivery capability of the SWP has been reduced 8 to 30 percent from forecasts made as recently as 2005. The same forces impacting SWP long-term reliability are also expected to affect CVP delivery capability.

Additionally, recent developments in the SFPUC WSIP Program EIR process indicate that San Francisco may not meet forecasted 2030 purchase requests and therefore, SFPUC supplies in Santa Clara County would likely be below levels assumed in its most recent UWMP. Furthermore, SFPUC supplies to cities of San Jose and Santa Clara would likely continue to be temporary and interruptible after the contract renewal process is completed, which is expected to occur by June 2009. Any reductions in SFPUC supplies would likely result in increased demand and dependence on District supplies and increased groundwater pumping in Santa Clara Valley groundwater subbasin.

While imported supplies will continue to be an essential part of Santa Clara County's water supply, the IWRP Study 2003 emphasized that investment in new local resources is needed to decrease vulnerability to risk and minimize dry-year dependence on the Delta. Recent developments in the Delta have added urgency to this necessity. Conservation, water recycling, and desalination were identified as essential parts of a more diverse and flexible water supply for the long-term. These resources provide all-weather water supply for the County. Since all-weather supplies are available every year, they have the most predictability and certainty, and when combined with storage provide additional operational flexibility at reasonable cost. The best performing supply portfolios evaluated for IWRP Study 2003 included a combination of all-weather supplies, storage, and dry-year transfers. IWRP Study 2003 concluded all three types of supply would be necessary to work together in harmony to meet future water needs.

Figure ES2. Updated SWP Delta Table A Delivery Probability Under Future Conditions



District Conservation Targets

The District, using 1992 as a baseline, has targeted baseline conservation water savings of 70,500 acre-feet by 2030 to be achieved through plumbing code requirements and District conservation programs. On top of the baseline target, the IWRP Study 2003 identified an additional 28,000 acre-feet of savings as part of the IWRP's "No Regrets" reliability investments.

The combined water savings targets in five-year increments are shown in Table ES1. These targets include water savings from all conservation activity in the county from 1992 to each year indicated in the table.

By 2030, water savings from conservation programs are projected to be the third largest source of water supply in Santa Clara County in normal years, behind local supplies and CVP imported water. In multiple dry years, conservation water savings are expected to provide supply comparable to CVP imports – 98,500 acre-feet versus 99,600 acre-feet. For a single-dry year, such as 1977, water savings from conservation would be the second largest source of water supply for the county. Only supply from groundwater reserves are projected to provide more supply for a single critically dry year.

Table ES1. District Water Savings Targets (1992 Baseline)

Year	2005	2010	2015	2020	2025	2030
2003 IWRP Baseline Conservation Program Savings (AF/Yr)	37,300	47,500	54,300	62,300	67,100	70,500
2003 IWRP "No Regrets" Conservation Savings (AF/Yr)*	0	3,400	9,800	20,200	24,100	28,000
Total Target (AF/Yr)	37,300	50,900	64,100	82,500	91,200	98,500

*Note that the implementation schedule for "No Regrets" conservation has been somewhat modified from the schedule presented in the 2005 UWMP in order to lower program implementation costs.

Re-Estimation of Baseline Conservation Program Savings

The Strategic Plan re-estimated baseline water savings to ensure that baseline and "No Regrets" water savings forecasts were derived from the same basic assumptions and model parameters used to estimate water savings for the Strategic Plan. The cumulative effect of these adjustments was a slight decrease in the projected baseline water savings to approximately 70,000 acre-feet by 2030. The adjustment to baseline water savings requires that the District generate an additional 28,500 acre-feet of "No Regrets" water savings by 2030 in order to reach its long-term savings target of 98,500 acre-feet -- 500 acre-feet more than the IWRP originally identified. Existing and new agricultural conservation programs are projected to provide up to 6,000 AFY by 2030. Urban conservation programs will need to provide the remaining 22,500 AFY, as shown in Table ES2.

Table ES2. Additional Urban Conservation Needed to Achieve District Target

Allocation of Long-Term Savings Target	2030 Water Savings (acre-feet)
Re-Estimated Baseline Water Savings	70,000
"No Regrets" Conservation Increment	
Existing and New Agricultural Programs	6,000
New Urban Conservation Programs	22,500
Total Savings/Long-Term Target	98,500

Achieving the Targets

Evaluation and Selection of Least-Cost Urban Conservation Programs

To identify least-cost "No Regrets" urban conservation programs for achieving the District's conservation target, the Strategic Plan evaluated 61 different potential

conservation programs. These programs were first subjected to a qualitative screening analysis to assess their suitability in terms of implementation feasibility, measurability of savings, customer/stakeholder acceptability, consistency with existing District policies and programs, and anticipated water savings and program costs. The qualitative screening analysis eliminated 35 potential programs, leaving 26 for detailed quantitative analysis.

Detailed analytic information was developed for each of the 26 remaining potential programs. This information included:

- The savings per unit (e.g. fixture, survey, participating customer, etc.) of program implementation, and the projected duration of those savings.
- The costs per unit that are incurred at the time of program entry (including administrative costs as well as customer rebates or other financial incentives), as well as ongoing per-unit and fixed annual costs that are expected to be incurred.
- Projected participation rates, that is, the number of units that are expected to enter the program each year.
- Expected rates of natural replacement and free-ridership.[3]

The data compiled for each potential program was then used with the American Water Works Association Research Foundation's Benefit-Cost Model to forecast the annual savings and costs of each program. The projected savings and costs for each program were combined to calculate the unit cost associated with that program. The unit cost measures how much the utility pays for each acre-foot of savings generated by the program over its life cycle. Results of the analysis are shown in Table ES3.

Ranking the conservation measures from low to high cost then identified the least-cost conservation plan. This process is depicted in Table ES3, where programs above the shaded region of the table represent the set of least-cost measures capable of achieving the long-term conservation target. The marginal cost of water savings, that is the cost of the last increment of water savings, in the plan, is $530/AF. The average unit cost across all programs included in the plan is $210/AF.

Cost-Sharing Can Change the Mix of Conservation Measures

The unit costs in Table ES3 do not account for cost-sharing and grant funding, and thus some grant-funded programs currently operated by the District are not part of the least-cost set of "No Regrets" conservation programs. In general, programs that secure cost sharing will become part of the least-cost set of "No Regrets"

3 Natural replacement reflects the effects of code requirements and/or market forces which results in a certain fraction of plumbing fixtures being replaced with water-conserving fixtures each year without utility intervention. Free riders are those customers who would have taken the conservation action targeted by the program without the program, but take advantage of the program's financial incentives. While natural replacement and freeridership reduce the active savings that can be attributed to the utility conservation program, they result in physical water savings and thus contribute towards the District's overall conservation targets. Their primary importance concerns the computation of costs and benefits of active conservation programs offered by the District.

conservation programs listed in this report provided the cost-sharing results in a unit cost of $530/AF or less.

Long-Term Plan Annual District Costs

Annual District costs to implement the least-cost set of "No Regrets" urban conservation programs are estimated to average approximately $4.2 million per year (2007 constant dollars).[4] Because this estimate does not assume any grant funding or cost-sharing, it constitutes an upper-bound annual cost for the long-term plan. Approximately 39 percent of annual District expenditure for urban conservation would go to single-family residential programs, 26 percent would go to multi-family residential programs, and 35 percent would go to commercial, industrial, and institutional (CII) conservation programs.

2030 Estimated Water Savings

The least-cost set of "No-Regrets" urban conservation programs save approximately 24,200 AFY by 2030, about 1,700 AFY more than required assuming agricultural programs would save an additional 6,000 AFY. These water savings are incremental to the baseline water savings of 70,000 acre-feet.

4 Cost estimates include all program-specific overhead and administration costs, but exclude fixed District staffing costs.

Table ES3. "No Regret" Urban Conservation Programs, Sorted from Low to High Cost*

Class of Service	Program	Unit Cost ($/AF)	B/C Ratio	2030 Savings (AF)	Cumulative Savings (AF)
CII	Lndscp Budget - Mixed Meter**	$9	71.14	5,121	5,121
CII	Lndscp Budget – Ded. Meter**	$14	46.75	4,843	9,963
MFD	Submetering: Mobile Homes	$124	4.53	140	10,103
CII	Medical Sterilizers - Condensate	$134	4.59	140	10,244
SFD	WBIC Rebates for Lrg Lndscp	$157	3.65	1,233	11,477
CII	WBIC Rebates for Lrg Lndscp	$158	3.63	1,409	12,886
MFD	Irr. Equip. Rebate for New Constr.	$236	2.45	52	12,938
CII	Leak Det & Repair Incentives	$238	2.58	1,731	14,669
CII	Lg Lndscp Srvy & Equip. Rebate	$259	2.22	603	15,272
SFD/ MFD	Lg Lndscp Srvy & Equip. Rebate	$263	2.19	302	15,574
CII	Industrial Process	$272	2.04	442	16,016
MFD	Submetering: New Construction	$285	2.23	94	16,110
CII	Medical Sterilizers - Ejector	$301	2.05	195	16,305
MFD	HET Direct Install	$381	1.63	2,165	18,470
MFD	Submetering: Existing Constr.	$398	1.61	1,292	19,762
CII	HET Install (high-use sectors)	$439	1.40	450	20,212
CII	Clotheswasher Rebate	$508	1.16	607	20,819
SFD	HET Rebate	$533	1.17	3,369	24,188
SFD	Irr. Equip. Rebate for New Constr.	$564	1.02	236	24,425

Class of Service	Program	Unit Cost ($/AF)	B/C Ratio	2030 Savings (AF)	Cumulative Savings (AF)
CII	HET Install (low-use sectors)	$933	0.66	582	25,007
CII	Food Steamers	$1,003	0.59	76	25,084
CII	Small Lndscp Equip. Rebate (excluding WBICs)	$1,015	0.57	66	25,149
CII	WBIC Rebates for Small Lndscp	$1,059	0.54	48	25,198
MFD	Washer Rebate: Common Area	$1,083	0.54	83	25,281
SFD	Washer Rebate	$1,220	0.48	1,061	26,342
CII	Landscape Rebate	$1,326	0.43	95	26,437
MFD	Landscape Rebate	$1,328	0.43	339	26,776
SFD	Landscape Rebate	$1,710	0.34	644	27,420
MFD	Washer Rebate: In-Unit	$3,045	0.19	120	27,540
SFD	Small Lndscp Srvy & Equip. Rebate (including WBICs)	$4,622	0.12	58	27,598

*Programs above the shaded region constitute the least-cost set of programs capable of achieving the District's long-term conservation target. Unit costs in the table do not account for cost-sharing and grant funding, and thus some grant-funded programs currently operated by the District are not part of the least-cost set of "No Regrets" conservation programs. In general, programs that secure cost sharing will become part of the least-cost set of "No Regrets" conservation programs listed in this report provided the cost-sharing results in a unit cost of $530/AF or less.

** Unit costs for landscape budgets are based on assumptions about unit costs, acres/site, usage per acre, and savings percentages developed by District landscaping consultants and result in very low cost water savings potential.

Shortage Management Policies and Conservation

District shortage management response is linked to the end-of-year storage in our three local groundwater sub basins. End-of-year groundwater storage levels trigger increasing levels of shortage response. The level of response is expressed in terms of the acre-feet of supplemental water supply or demand management required to address the shortage. The indicated response is intended to be flexible and will be tailored to opportunities available at the time. Potential responses include: voluntary water use reduction/public outreach (including media campaigns, increased water conservation literature, conservation kit distribution, and residential surveys), followed by demand reduction measures or increased

supplies. The District's shortage response action guidelines do not specify the form of the drought response. Annual decisions, including whether to participate in the water market or call for demand cutbacks, are made through annual operations planning.

The Strategic Plan evaluated potential demand management responses available to the District, savings potential of these responses, and their expected cost.

Demand management responses would be incremental to the implementation of long-term conservation programs previously described. The Strategic Plan considered three types of demand management response. These were:

- Use of Public Information and Outreach to Change Water Use Behaviors
- Acceleration of Long-term Conservation Programs; and
- Mandatory Restrictions and Price-Induced Conservation

Public Information and Outreach

Public information and outreach is typically one of the first responses implemented by the District when confronting a pending or existing water shortage. In the context of a water shortage, the District uses public information and outreach to alert the public to the need to reduce water use and to provide information and tips on how this can be accomplished at low cost and with minimal inconvenience.

The effectiveness of public information and outreach in addressing temporary shortages has proven hard to measure. Partly this is because public information and outreach is typically run concurrently with other demand management programs making it difficult to disentangle the various policies and programs affecting water use. Also, there is no one standard model for public information and outreach. Public information programs typically vary among water agencies in terms of structure, content, and funding.

Based on an extensive review of the literature (Syme, et al. 2000) and a behavioral response analysis, the Strategic Plan concluded that public information and outreach campaigns were most likely to result in short-term and mostly temporary water savings in the 5 to 10 percent range. While it is certainly possible that such campaigns could result in water savings in excess of 10 percent, limiting the assumed response to 10 percent was viewed as an appropriately conservative assumption for planning purposes.

Water savings potential from public information and outreach was found to depend to a significant degree on the level of investment in the campaign. Saturation messaging through mass media, especially television and radio, were shown to have the greatest impact on water use during shortages (Syme, et al. 2000). Large-scale campaigns were generally more effective than smaller ones; repetitive messaging was more effective than infrequent messaging. Using an empirically derived relationship between public information expenditure and water demand (Mercer and Morgan, 1980), the Strategic Plan estimated the amount of water savings potential associated with increasing levels of expenditure for

public information aimed at reducing water demand. The results of this analysis were then checked against public water agency public information expenditure and water demand reductions observed during California's 1987-92 drought and were determined to be within the plausible range of savings and costs. The results are shown in Table ES4.

Table ES4. Public Information and Outreach Shortage Management Response Cost and Water Savings

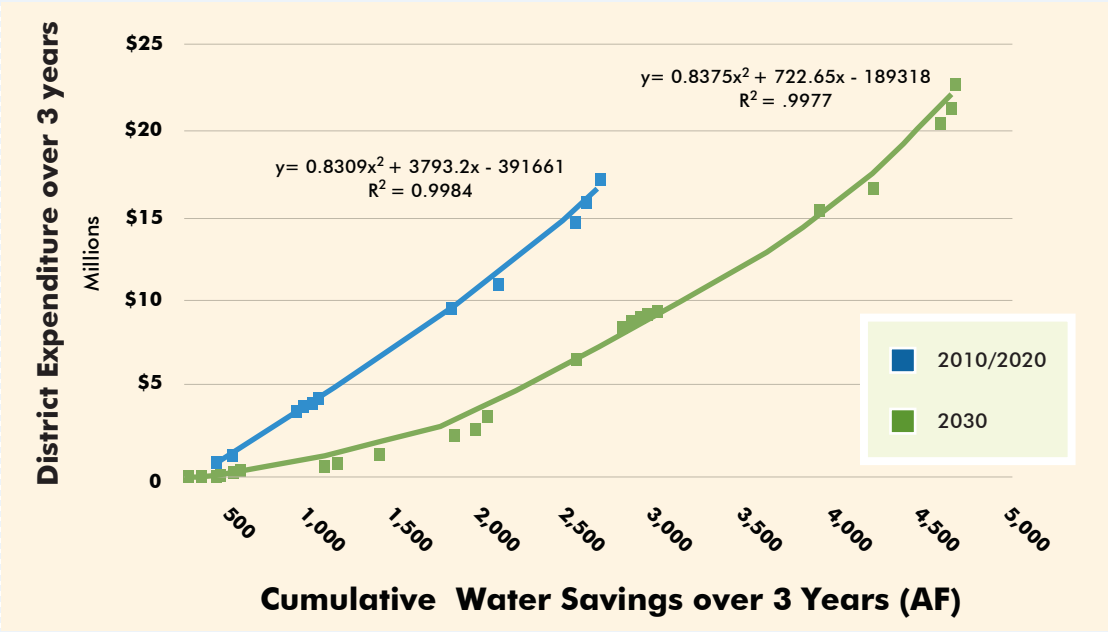
% Demand Reduction	Shortage Starts in 2010		Shortage Starts in 2020		Shortage Starts in 2030	
	Expenditure (mil. $/yr)	TAF	Expenditure (mil. $/yr)	TAF	Expenditure (mil. $/yr)	TAF
2.0%	0.79	7.1	0.87	7.6	0.99	8.5
4.0%	1.07	14.2	1.20	15.3	1.37	17.0
6.0%	1.36	21.3	1.53	22.9	1.75	25.5
8.0%	1.64	28.4	1.86	30.5	2.14	33.9
10.0%	1.92	35.5	2.19	38.1	2.52	42.4

Acceleration of Long-Term Conservation Programs

In addition to investing more in public information/awareness campaigns, the District also can temporarily expand its long-term regional conservation programs during a water shortage. The Strategic Plan evaluated the potential water savings over three years from temporarily expanding a subset of conservation measures evaluated for the long-term plan. Because the availability of conservation measures changes over the planning period in response to implementation of measures to achieve the long-term conservation target, the analysis considered potential savings for 2010, 2020, and 2030. Analysis results were used to generate water shortage management supply curves, shown in Figure ES3.

The curves in Figure ES3 show the cumulative water savings over 3 years and associated District expenditure from accelerating the implementation of long-term conservation measures. The steeper, shorter curve for 2030 reflects the fact that by 2030 several of the lower-cost long-term measures have no remaining savings potential.

Figure ES3. Conservation Measure Water Shortage Supply Curves: 2010/2020 and 2030



Mandatory Restrictions and Price-Induced Conservation

The District is currently reviewing its authority to adopt ordinances, impose mandatory provisions restricting the wasteful use of water, or set or enforce consumption limits at the retail level. Because of uncertainty regarding the District's ability to pursue these types of measures, the Strategic Plan did not consider per capita allotments, inclining-block rates, penalties, or incentives for demand reduction for any customer class. The development of such mechanisms is within the purview of cities, the County and the local retail water agencies. In the event of severe water shortage, the District will work with local retail water suppliers to establish water use reduction targets. By working closely with its retail water agencies, the District has effectively set and achieved up to 25 percent mandatory water use reduction levels in the past. This level of water savings from mandatory water use restrictions and pricing is consistent with savings from mandatory measures estimated by Hanemann and Nauges (2005), Renwick and Green (2000), and RAND (1996).

Summary of Conservation Response Potential for Shortage Management

Public information and outreach campaigns were found to be the most effective immediate demand management response to temporary water shortages in terms of both water savings potential and cost-effectiveness. Public information and outreach emphasizes changes in behavior to reduce water use. Effective messaging coupled with outreach programs (such as the residential survey program) can generate significant short-term reductions in demand at relatively low cost to the District. The demand reductions are driven primarily by changes

in behavior, most of which may involve added inconvenience and cost (e.g. damaged or destroyed landscaping) to water users. Experience with previous droughts suggests that demand is likely to rebound following the shortage as customers revert to pre-drought water using habits (e.g. longer showers, washing hard surfaces, more frequent or intensive landscape watering). Only a small fraction of the behavioral-based water savings achieved during a shortage are likely to persist over the long-term.

While accelerating water savings from long-term conservation measures to produce short-term water savings for shortage management is feasible, the water savings potential is not very great and the cost is high. These measures are primarily designed to improve the efficiency of water using fixtures, appliances, processes, and landscapes over a long period. Unlike behavioral responses, water savings from these measures are persistent and accrete to produce significant efficiency gains over the long run. However, a rapid expansion of these programs in response to a temporary shortage would require considerable District expenditure and would generate a limited amount of short-term water savings. For this reason, investment in these measures for shortage management should be pursued only if coupled to investment in public information and outreach.

Expected shortage response and cost of public information and outreach are summarized in Table ES5. Short-term savings potential and cost from accelerating long-term conservation programs are summarized in Table ES6.

Table ES5 shows the amount of water savings potential over a three-year shortage for varying levels of public information/outreach expenditure. For example, a cumulative reduction of 75 TAF over three years (or about 25 TAF/Yr) is projected to cost about $4.5 million in 2010. Achieving the same magnitude of savings in 2020 and 2030 is expected to cost more due to demand hardening. Table ES6 shows the same type of information, but for accelerating long-term conservation programs to increase water savings during a temporary shortage.

Table ES5. Public Information/Outreach Shortage Response Water Savings and Costs

Cumulative Water Savings Over 3 Years	3-Yr Cost to Achieve Cumulative Savings		
	Shortage Starts in 2010	Shortage Starts in 2020	Shortage Starts in 2030
(TAF)	(Mil $)	(Mil $)	(Mil $)
15	2.1	2.3	2.5
30	2.7	2.9	3.2
45	3.3	3.6	3.8
60	3.9	4.2	4.5
75	4.5	4.9	5.2
90	5.1	5.5	5.9
105	5.7	6.2	6.6
120	*	6.8	7.2
135	*	*	7.9

* Cumulative savings from public information/outreach capped at 10 percent of projected demand.

Table ES6. Accelerated Long-Term Conservation Shortage Response Water Savings and Costs

Cumulative Water Savings Over 3 Years	3-Yr Cost to Achieve Cumulative Savings		
	Shortage Starts in 2010	Shortage Starts in 2020	Shortage Starts in 2030
(TAF)	(Mil $)	(Mil $)	(Mil $)
0.5	0.4	0.4	1.5
1.0	1.4	1.4	3.7
1.5	2.8	2.8	6.4
2.0	4.6	4.6	9.5
2.5	6.9	6.9	13.0
3.0	9.5	9.5	17.0
3.5	12.6	12.6	21.3
4.0	16.1	16.1	26.1
4.5	20.0	20.0	31.3
5.0	24.4	24.4	36.8

Monitoring and Evaluation

To verify that water conservation efforts meet the 2003 IWRP and 2005 UWMP 2030 goals of 98,500 acre-feet per year of water savings, water conservation staff will collect and document program activity levels for residential, commercial, industrial, institutional and agriculture sectors and update the Strategic Plan Active Water Savings Tables quarterly. In addition to monitoring active savings resulting from program activity levels, it is also necessary to continue to document passive savings in order to fully assess total water savings in Santa Clara County. District staff will collect and document annual passive water savings garnered by natural replacement, legislation, and municipal or county ordinances and update the Strategic Plan Passive Water Savings Tables.

Strategic Plan Updates

Water conservation staff will update the least cost program implementation plan on a five-year cycle. This update will include the introduction of new water saving technologies and their associated costs and savings. The update will also include program activity data that may verify or alter assumptions made regarding selected least-cost plan programs water savings or costs.

Introduction

The Santa Clara Valley Water District (District) is the primary water resources agency for Santa Clara County, California. It acts not only as the county's water wholesaler, but also as it's flood protection agency and is the steward for its streams and creeks, underground aquifers and District-built reservoirs.
As the county's water wholesaler, the District makes sure there is enough clean, safe water for homes and businesses. As the agency responsible for local flood protection, the District works diligently to protect Santa Clara Valley residents and businesses from the devastating effects of flooding. The District's stream stewardship responsibilities include creek restoration and wildlife habitat projects, pollution prevention efforts and a commitment to natural flood protection.

The District's water conservation, water recycling, and desalination programs reduce demand on existing imported and groundwater supplies and assist in meeting the District Board's Ends Policies for water supply reliability, water conservation, and water recycling. These policies, in conjunction with the District's 2003 Integrated Water Resources Planning Study (IWRP 2003) and the 2005 Urban Water Management Plan (UWMP 2005), require that:

- Water conservation is implemented to the maximum extent that is practical;
- Water recycling is expanded within Santa Clara County in partnership with the community; and
- A variety of water supply sources, including conservation, recycling, and desalination, are available to minimize risk.

In addition to these broad policy objectives, the District has established the following numeric targets for recycled water and conservation:

- Water recycling is to reach 5 percent of total water use or 19,100 acre-feet by 2010 and 10 percent or 40,500 acre-feet by 2020.
- Water conservation is to achieve 98,500 acre-feet of water savings by 2030, consisting of:
  - 70,500 acre-feet by 2030 from implementation of Best Management Practices (BMPs) and water use efficiency code requirements.[1]
  - 28,000 acre-feet above and beyond water savings from BMPs and water use efficiency code requirements, per the IWRP Study 2003 identification of "No Regrets" near-term reliability investments.

The Water Use Efficiency Strategic Plan (hereafter Strategic Plan) is intended to provide a blueprint for meeting these policy objectives and targets. Its purpose is to evaluate and recommend WUE measures for meeting District policy

1 This report uses the terminology "water use efficiency codes" to refer to state and federal laws affecting the water use efficiency of toilets, urinals, showerheads, and other water using devices and appliances. The Strategic Plan's analysis of BMP implementation and water savings is based on BMP definitions and requirements as of July 2008.

objectives and targets for water conservation, water recycling, and desalination; develop schedules for implementation; estimate costs; and identify protocols for monitoring and evaluating program performance over time.

1.1. Strategic Plan Phasing

The Strategic Plan is being developed in two phases. Policies and measures for long-term water conservation and water shortage management are addressed in this, the Phase 1, report. Water recycling and desalination will be addressed in the Phase 2 report. Phasing of the Strategic Plan is being done for two reasons.

First, there is an immediate need for analysis of near-term conservation and shortage management measures that could help the District manage possible water shortages stemming from federal court imposed interim rules for water flows in the Sacramento-San Joaquin River Delta (hereafter Delta) that are expected to significantly impact the District's SWP and CVP water supplies in 2008 and possibly for many years thereafter. Responding to this immediate need, the District chose to prioritize the development of the conservation component of the Strategic Plan over the development of the recycling and desalination components.

Second, information needed for the water recycling and desalination components of the Strategic Plan was not available in time for the Phase 1 report. The District's Water Recycling & Desalination Program consists of infrastructure type projects (e.g. recycled water pipelines or facilities, desalination pilot plants), water quality projects (e.g. monitoring for water quality parameters), and institutional arrangements (e.g. recycled water incentive agreements). These efforts are conducted sometimes solely to meet District needs or in partnership with other recycled water producers and water agencies in this region.

In the case of recycling, the District is currently considering a more robust, long-term recycled water partnership agreement. The District and City of San Jose established a Joint Committee to review and attempt to reach consensus and provide direction to District and City staff on a number of issues, including recommended form of partnership between the District and the City, roles and responsibilities relative to existing South Bay Water Recycling distribution system, roles, responsibilities, cost share, and ownership of future advanced treatment facilities, and rates for recycled water. Because the outcome of these deliberations may significantly reshape investment, oversight and management of recycled water projects in Santa Clara County, strategic planning for recycling must wait for further resolution of these key issues.

In the case of desalination, the District, in partnership with other Bay Area water agencies, has initiated investigations into the feasibility and cost-effectiveness of a large-scale regional desalination facility. These investigations will produce a range of information needed for desalination strategic planning, including the viability of a complex regional project in which stakeholders have different needs, priorities, and constraints; an assessment of site and infrastructure conguration

options based on environmental, permitting, cost and design implications; a scope of work for detailed environmental analysis for a full-scale regional facility; and information on the costs and benefits of a centralized regional project. Phase 2 of the Strategic Plan will commence upon completion of these key investigations and studies.

1.2. Organization of the Phase 1 Report

Phase 1 of the Strategic Plan is organized into nine sections, including this introduction. The remaining sections of the Phase 1 report cover the following:

- Section 2 provides an overview of District water supplies, water demands, system characteristics, and water supply reliability, including near-term risks to the District's imported water supply and the potential for near-term water shortages;
- Section 3 reviews the District's long-term water conservation policies and targets and defines shortage scenarios for evaluation of demand management measures that could help the District manage possible water shortages resulting from drought, regulatory restrictions on Delta operations, or natural or human-caused disruption of water supply infrastructure.
- Section 4 gives an overview of District conservation programs to date, including updated forecasts of water savings from past program implementation and the enactment of water use efficiency codes, and need for additional conservation measures to achieve District long-term conservation targets.
- Section 5 presents the evaluation of current and proposed conservation measures, including estimated near- and long-term water savings, measure costs, and measure cost-effectiveness.
- Section 6 develops the Long-Term Conservation Plan, and covers the District's long-term conservation targets; conservation measures, level of implementation, schedule to achieve long-term conservation targets; estimated costs of proposed measures; and compliance with the Memorandum of Understanding Regarding Urban Water Conservation in California (hereafter MOU).
- Section 7 covers recommended conservation measures and shortage management policies for one- and three-year shortage scenarios, estimated water savings, and expected costs to the District, the District's retailers, and end users.
- Section 8 discusses monitoring and evaluation of conservation program effectiveness, water savings, and costs.
- Section 9 describes the process for updating the Near- and Long-Term Conservation Plans over time and in the light of new information and changed circumstances.

2 Overview of District Service Area, Water Supplies, and Demands

2.1. Section Introduction

Santa Clara County is home to a dynamic economy and approximately 1.8 million people. The county's economy provides almost 30 percent of all the jobs in the Bay Area. Nicknamed "Silicon Valley," historically about one of every five of the county's jobs was in high technology. Beginning more than a century ago with the county's roots in agriculture to its present-day position as the world's leading center of high technology, a clean, reliable, and affordable water supply has been one of the key ingredients to the region's success.

In this section of the Strategic Plan, the District's service area, water supplies, projected water demands, and supply-demand balances for normal, dry, and multiple dry years as presented in its 2005 UWMP are reviewed. Following this review, immediate and longer-term challenges confronting the District's imported water supply are discussed along with the broad approaches – including conservation, recycling, and desalination -- laid out by the UWMP and IWRP 2003 for addressing these challenges.

2.2. Service Area Description

The District has a diverse mix of water supplies and a strong commitment to water use efficiency. The District's water supply system is a complex interdependent system comprised of storage, conveyance, treatment, and distribution facilities that include water treatment plants, local reservoirs, recharge ponds, canals, groundwater subbasins, imported water supply facilities, and raw and treated water conveyance facilities. The District supplies water to local water retail agencies, which in turn provide it to their customers in Santa Clara County.

The District owns and manages 10 local surface reservoirs with a total storage capacity of 170,000 acre-feet, manages the county's groundwater subbasins and recharge facilities, operates three water treatment plants, imports water from the Central Valley Project (CVP) and the State Water Project (SWP), and delivers recycled water to parts of the county.

The District encompasses all of the county's 1,300 square miles and serves the area's 15 cities, more than 1.8 million residents and 200,000 commuters. The District sells both treated water and groundwater to 13 local water retail agencies that serve communities within the county and has primary responsibility for the management of the county's groundwater subbasins used by private well owners.

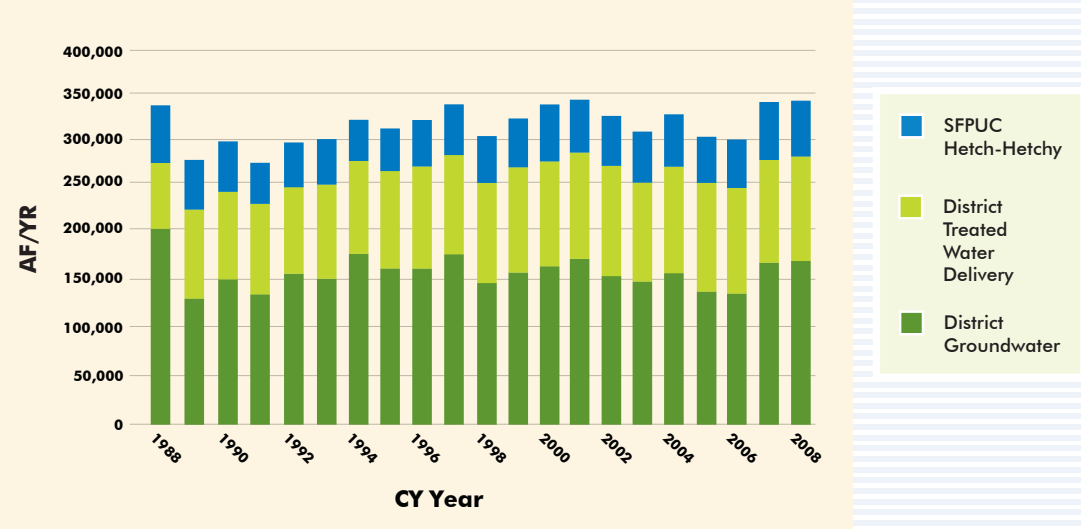
2.3. District Water Sources, Yields, and Reliability

Since 1989, when the last of the three District water treatment plants came on line, the various sources of water for Santa Clara County have remained relatively constant as a percentage of total supply, as illustrated in Figure 1. Groundwater

represents the biggest share of total use, ranging from 41 to 51 percent of total water use. Treated water represents the second largest share from 30 to 38 percent of total water use. SFPUC supplies (from the Hetch Hetchy system) represent the third largest share ranging from 16 to 19 percent of total water use. Other sources not shown in the figure include recycled water (less than 3 percent) and other local surface water (non-District 4 to 5 percent).

While the distribution of these sources has remained relatively constant over the past 15 years, it may not be representative of future years. Several important and sometimes dynamic factors play a role in affecting the use of a particular water source. Hydrology is probably the most important and dynamic of these factors. In subsequent dry years, there may be less imported and local surface water to distribute to the treatment plants and thus groundwater use may increase.

Figure 1. Santa Clara County Major Water Supply Sources



2.3.1. Groundwater Supplies

Groundwater supplies about half of the county's water use during average years and nearly all of the water demand in south Santa Clara County. The District's active conjunctive water management program uses surface water in conjunction with groundwater to optimize the use and management of water supply sources. Surface water is treated for distribution (reducing direct demands on groundwater) and is also banked in local subbasins through managed recharge so that groundwater can be withdrawn when needed. Conjunctive use also helps protect local groundwater subbasins from overdraft, land subsidence, and saltwater intrusion and provides critical groundwater storage reserves for use during droughts or outages. Conjunctive use management is an important tool that allows the groundwater basin to be pumped more in drier years and then replenished (or recharged) during wet and average years. Groundwater

is replenished both naturally from rainfall and augmented by District-operated recharge facilities and streams.

2.3.2. Imported Water Supplies

Imported water comes to the county from Northern California watersheds via the Sacramento-San Joaquin Delta. The State Water Project (SWP) and the Central Valley Project (CVP) deliver this water. Imported water is conveyed to Santa Clara County through two main conveyance facilities: the South Bay Aqueduct, which carries SWP water from the South Bay Pumping Plant; and the Santa Clara Conduit and Pacheco Conduit, which bring CVP water from the San Luis Reservoir. The San Francisco Public Utilities Commission conveys its water into Santa Clara County and other counties through its own facilities.

The amount of imported water available to Santa Clara County varies due to natural fluctuations in precipitation as well as changing water quality and ESA requirements in the Delta. In average water years, Santa Clara County imports about 260,000 acre-feet of water. However, during a prolonged dry period, such as occurred between 1987 and 1992, imported water may fall to 75 percent of its normal year average. In a critically dry year, such as 1977, imported water may drop to about 50 percent of its normal year average.

Table 1 summarizes the contract amount, historic normal year, multiple dry year, and single dry year for each of the three sources of imported water for the county based on 2005 system conditions.

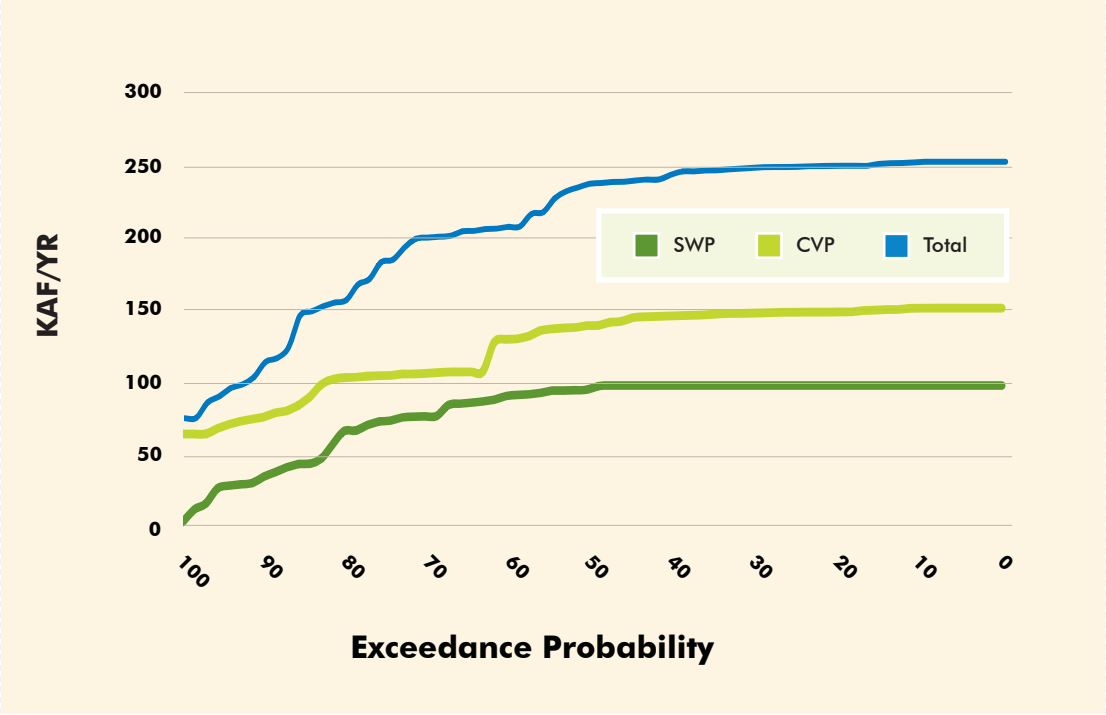
Table 1. Santa Clara County Imported Water Supplies (AF/Yr)

Source	Contract Amount	Normal Year (1985)	Multiple Dry Years (1987-1992)	Single Dry Year (1977)
SWP	100,000	83,000	42,000	5,000
CVP	152,500	114,400	99,600	83,600
SFPUC	N/A	60,000	48,000	45,000

Uncertainty of imported water can be expressed in terms of exceedance probabilities, which measure the likelihood of imported water deliveries given historic hydrology and current Delta export capability and regulation. Figure 2 shows exceedance probability curves estimated by the IRWP Study 2003 for the District's CVP and SWP supplies. The curves show that about 90 percent of the time SWP and CVP water deliveries are predicted to be less than the District's full contractual entitlement of 252,500 acre-feet. The curves also show SWP and CVP deliveries are expected to drop below 80 percent of contractual entitlement about 30 percent of the time, and below 40 percent of contractual entitlement about 10 percent of the time. The District conducts similar analysis of Hetch Hetchy imports for planning and operational purposes.

The exceedance probabilities shown in Figure 2 are based on historic hydrology and Delta operating conditions at the time the curves were generated. As conditions in the Delta change and as hydrology deviates from historic patterns (for example, because of climate change), the exceedance probabilities will change. As will be discussed subsequently, both recent developments in the Delta and long-term changes in climate are expected to reduce the reliability of Santa Clara County's imported water supply from what is depicted in Figure 2.

Figure 2. Exceedance Probability for CVP and SWP Supply



2.3.3. Non-District Local Supplies

Other agencies in the county also develop water locally. The San Jose Water Company (SJWC) and Stanford University both hold surface water rights. Stanford's local water development is small. SJWC, however, has developed an average yield of 9,500 acre-feet from diversions and storage in the Upper Los Gatos Creek watershed and a run-of-the-river treatment facility on Saratoga Creek. These projects are considered part of the local surface water supply available to the county.

2.3.4. Recycled Water and Desalination

Recycled water is a local water source developed by the county's four wastewater treatment plants. The District works with the wastewater authorities in the county through partnerships to promote water recycling through financial incentives

and technical assistance. Water recycling involves the collection of wastewater discharged within the county, treating and purifying the water to the standards set forth by the California Department of Health Services (DHS), and using the recycled water for non-potable uses in lieu of potable supplies. All recycled water used in Santa Clara County is tertiary treated recycled water, which means it has undergone three stages of treatment. The second stage of treatment is sufficient for landscape irrigation according to DHS. In Santa Clara County recycled water providers go above that standard, and provide a higher quality of recycled water. In FY 07/08 approximately 16,700 acre-feet of non-potable recycled water was used in the county thereby conserving potable supplies.

The District is committed to meet the District Board's recycled water targets of 5 percent of total water use or 19,100 acre-feet by 2010 and 10 percent or 40,500 acre-feet by 2020. Projections from the county's recycled water producers based on existing and planned recycled water projects are for 31,200 acre-feet of recycled water by the year 2030, indicating a need to develop an additional 9,300 acre-feet of recycled water in order to meet the 2030 target. The District is considering options for additional recycling to meet the target, including advanced recycled water treatment for groundwater recharge and stream flow augmentation.

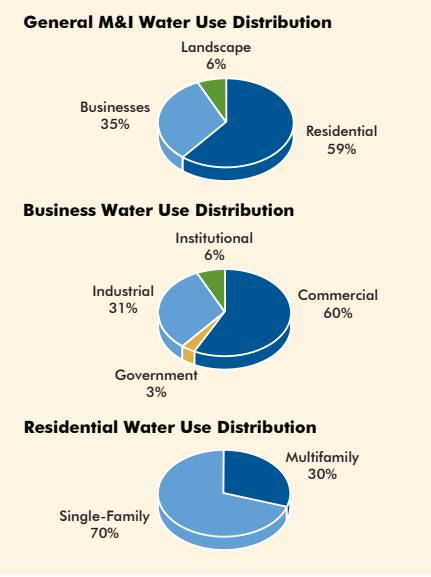
While desalination is not part of Santa Clara County's current water supply mix, the IWRP Study 2003 identified it as a potential future source of water for the region that would provide supply diversification and dry-year reliability. Two feasibility studies, addressing desalination of bay water and desalination of brackish groundwater, are underway.

Approaches to achieving the District's recycled water objectives and targets, as well as other strategies involving desalination, will be evaluated in the Strategic Plan's Phase 2 report.

2.4. Service Area Water Demands

As part of the 2005 UWMP the District updated the water demand forecast from the IWRP Study 2003. The updated water demand projection for the county is based on the most current demographic projections available by census tract at the time the analysis was performed (ABAG Projections 2005). The exception to this is the demand projections for the specific common SFPUC customers that are based upon the 2003 SFPUC Demand Study Report. In that study, ABAG 2002 projections were used for the end use model developed for SFPUC by URS Corporation. In order to ensure consistency with the District's overall demand projections, the SFPUC projections for the common SFPUC customers were compared to the District projections using ABAG Projections 2005. The District demand projection for the common SFPUC customers and all the retailers as a whole was within an acceptable tolerance of 1 percent.

Figure 3. Water Use Distribution



2.4.1. Water Use by Sector

Currently, District records show that the water use in the county is about 91 percent municipal and industrial (M&I) and about 9 percent agricultural.

The estimated breakdown by M&I sector, based on water retailer sales data, is shown in Figure 3. Among M&I water users, the residential sector is the largest user of water in Santa Clara County, accounting for 59 percent of M&I water demand. The business sector, which includes commercial, industrial, institutional, and government water uses, accounts for 35 percent of demand. Landscape served with dedicated meters accounts for the remaining 6 percent of M&I demand. Because water used to irrigate most landscape in the county is delivered through mixed-use meters, the fraction of total M&I water used for landscape irrigation is much larger than suggested by Figure 3. Typically, half or more of residential water use is for landscape and other outdoor uses. In the commercial, institutional, and government sectors a quarter to half of all water use is typically for landscape irrigation.

2.4.2. Water Use Forecast

Table 2 tabulates M&I and agricultural water demand projections as well as the projected water savings from conservation programs, as reported in the 2005 UWMP. The year 2000 was used as the base year for UWMP demand and water conservation projections. Because conservation water savings from 1992-2000 are already incorporated into year 2000 water use they are not included in the table's water savings projection to avoid double counting. This causes the projected water savings in Table 2 to appear to be less than the District's 2030 conservation target discussed in Section 1 – 74,200 acre-feet versus 98,500 acre-feet. The difference, 24,300 acre-feet, is the estimated water savings from conservation during the period 1992-2000.

Overall, countywide water demand is projected to increase by about 70,000 acre-feet (af) or 18 percent over the next 25 years, even with increases in new water conservation efforts. Demand with conservation programs in place in 2030 is projected at approximately 450,000 acre-feet.

Table 2. 2005 UWMP Water Demand and Conservation Projections (AF/Yr)

Year	2005	2010	2015	2020	2025	2030
M&I Demand	360,600	385,200	414,600	441,400	466,600	492,400
Ag. Demand	30,000	30,000	30,000	30,000	30,000	30,000
Baseline Conservation Programs	(13,000)	(23,200)	(30,100)	(38,000)	(42,800)	(46,200)
IWRP Study 2003 "No Regrets" Conservation		(9,300)	(18,600)	(28,000)	(28,000)	(28,000)
Total Conservation*	(13,000)	(32,500)	(48,700)	(66,000)	(70,800)	(74,200)
Net Demand	377,600	382,700	395,900	405,400	425,800	448,200

*Because conservation water savings from 1992-2000 are already incorporated into year 2000 water use they are not included in the table's water savings projection to avoid double counting. This causes the projected water savings in Table 2 to appear to be less than the District's 2030 conservation target discussed in Section 1 – 74,200 acre-feet versus 98,500 acre-feet. The difference, 24,300 acre-feet, is the estimated water savings from conservation during the period 1992-2000.

2.5. Normal and Dry Year Supply-Demand Balance

Table 3 shows the UWMP's projected 2030 supply-demand balance for normal year, multiple dry year, and single dry year conditions. By 2030, water savings from conservation programs are projected to be the third largest source of water supply in Santa Clara County in normal years, behind local supplies and CVP imported water. In multiple dry years, conservation water savings are expected to provide supply comparable to CVP imports – 98,500 acre-feet versus 99,600 acre-feet. For a single-dry year, such as 1977, water savings from conservation would be the second largest source of water supply for the county. Only supply from groundwater reserves are projected to provide more supply for a single critically dry year.

Table 3 illustrates the key role water conservation is expected to play in providing long-term supply reliability to Santa Clara County. Absent the projected water savings from conservation, the County would need approximately an additional 100,000 acre-feet of firm water supply to avoid water shortages in most years. As will be discussed in the following section, immediate risks to the County's imported CVP and SWP water supplies may require immediate investments in conservation as well.

Table 3. 2005 UWMP Year 2030 Supply Demand Comparison Normal, Dry, and Multiple Dry Years (1)

	Normal Year	Multiple Dry Years	Single Dry Year
SWP	83,000	42,000	5,000
CVP	114,400	99,600	83,600
Local Supplies	115,500	100,100	64,300
Recycled Water (1)	31,200	31,200	31,200
SFPUC (2)	73,000	58,400	54,700
New Supplies - IWRP Framework	31,100	13,700	0
Semitropic	0	27,200	23,200
Groundwater Reserves	0	76,000	186,200
Total Supply	448,200	448,200	448,200
Demand w/o Consv (3)	546,700	546,700	546,700
Supply – Demand	-98,500	-98,500	-98,500
Demand w/ Consv (4)	448,200	448,200	448,200
Supply - Demand	0	0	0

Notes:
(1) Adapted from Tables 6-2, 6-3, and 6-4 in the 2005 UWMP.
(2) Recycled water projections based on estimates provided by county recycled water producers, not Board Ends Policy targets.
(3) Assumes SFPUC's Regional Water Supply Improvement Plan completed by 2015.
(4) For comparison with Table 2 the 1992-2000 conservation savings of 24,300 acre-feet should be subtracted from these amounts.
(5) Includes baseline conservation and additional 28,000 acre-feet from IWRP Study 2003 "No Regrets" conservation building block.

2.6. Supply Reliability Challenges Confronting District

In a normal year, half or less of Santa Clara County's water is drawn from local groundwater aquifers or rainwater captured in the district's reservoirs. The balance originates hundreds of miles away - first as snow in the Sierra Nevada range of northern and eastern California, then as river water that empties into the Sacramento-San Joaquin River Delta. As previously described, this imported water is brought into the county through the SWP, the CVP, and San Francisco's Hetch Hetchy system.

While the county's imported water supply has always been variable due to vagaries in weather and precipitation, recent decisions affecting current operations of CVP and SWP Delta facilities as well as long-term threats to these

systems due to climate change and Delta levee fragility pose significant risks to the reliability of the county's imported water supply.

2.6.1. Immediate Risks to Santa Clara County Imported Water

In December 2007, a federal court imposed interim rules that will significantly restrict the operations of both the SWP and the CVP while a new federal biological opinion for Delta smelt is written in 2008. The California Department of Water Resources (DWR) has estimated that if 2008 is a dry year, SWP customers will receive seven to 22 percent less Delta water than would have been available without the court decision. If 2008 is an average water year, exports will be reduced 22 to 30 percent.[1] Figure 4 shows DWR's current estimate of how the court decision is expected to impact SWP deliveries in the near-term. Under the interim rules, SWP deliveries are expected to decrease 93% of the time, with an average decrease of approximately 15.6 percent.[2] Impacts to CVP Delta exports are expected to be of similar magnitude.

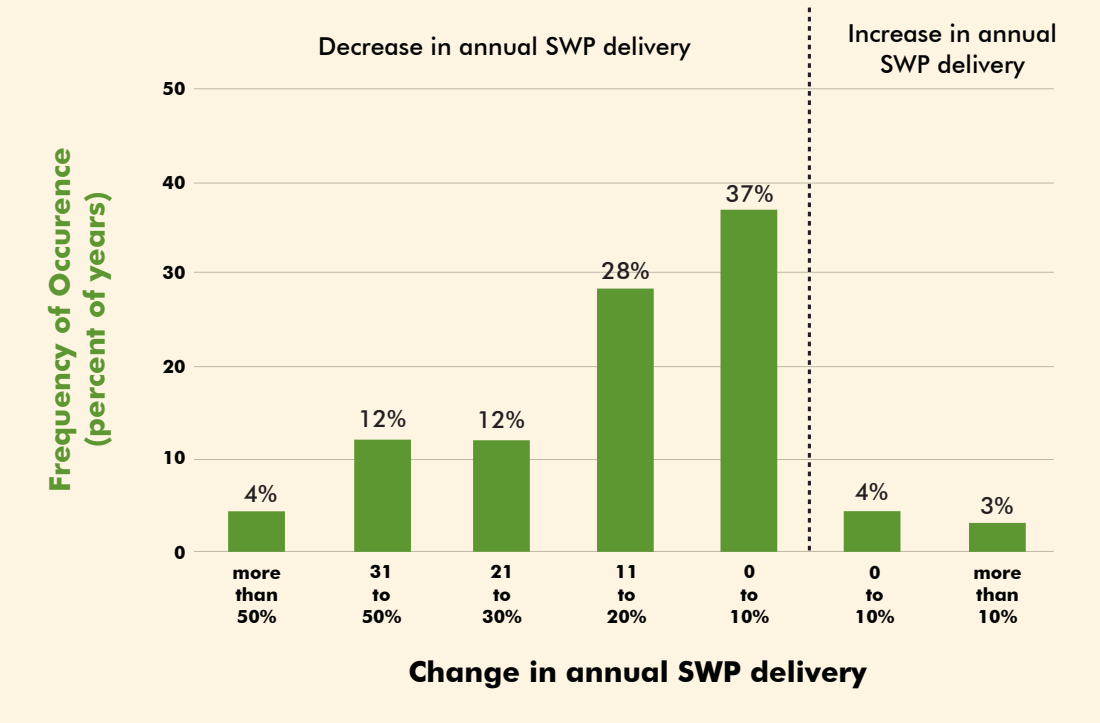
Although the interim rules apply only while the new federal biological opinion for Delta smelt is being written, the new opinion may similarly impact the reliability of SWP and CVP exports. Moreover, recent sharp declines in other pelagic and salmonid fish populations in the Delta may result in further restrictions on water exports. Thus, Santa Clara County potentially faces the immediate and continuing loss of between 10 and 20 percent of its water supply in normal water years as a consequence of more stringent regulations in the Delta.[3] This water would need to be replaced by other sources of supply (e.g. local groundwater reserves, Semitropic banked groundwater) and demand management.

1 This report uses the terminology "water use efficiency codes" to refer to state and federal laws affecting the water use efficiency of toilets, urinals, showerheads, and other water using devices and appliances. The Strategic Plan's analysis of BMP implementation and water savings is based on BMP definitions and requirements as of July 2008.

2 The average decrease was approximated by multiplying the probabilities in Figure 2 by the mid points of the corresponding ranges of change in annual SWP delivery. The maximum decrease and increase in delivery were assumed to be 50 and 10 percent, respectively.

3 Estimate based on 2010 water supply projections listed in Table 6-2 of the 2005 UWMP and assuming SWP and CVP exports are curtailed by between 22 and 30 percent in normal water years, per DWR estimates.

Figure 4. Impact of Federal Court Order on SWP Deliveries



2.6.2. Long-Term Risks to Santa Clara County Imported Water

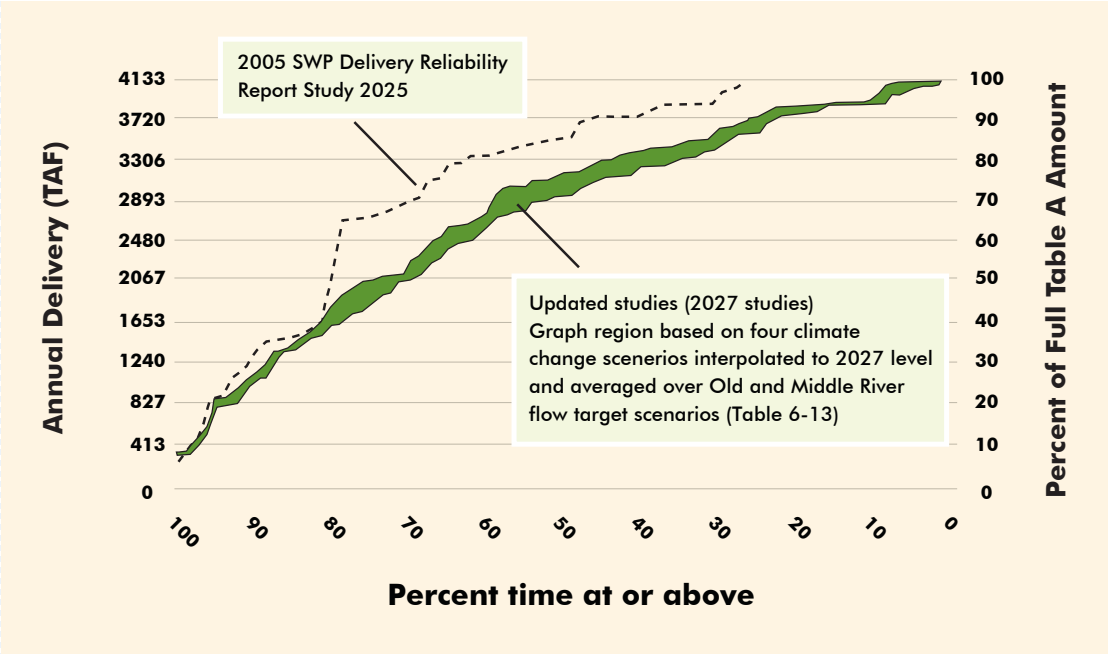
Competing beneficial uses, varying weather patterns, and complex statewide and Delta operations, regulations and institutional issues historically have shaped long-term reliability of Santa Clara County's imported water. In the last 15 years, major changes have been made in operating the SWP and CVP as a result of State Water Resources Control Board regulations to protect Delta water quality, and as a result of required actions under the Endangered Species Act to protect and restore endangered and threatened fish species. These regulations have required substantial increases in Sacramento Valley stream flows and Delta outflow, as well as reduced Delta exports at certain times of the year. Over the next several decades reliability of Santa Clara County's imported water may erode further as a result of global warming, growing risk of levee failure in the Delta, more stringent water quality standards, and the uncertain fate of CALFED program improvements such as the Banks Pumping Plant expansion.

As a result of recent developments in the Delta, new information on climate change impacts, and a better understanding of the vulnerability of Delta levees to flood and seismic events, DWR has substantially lowered its 2005 estimate of long-term SWP reliability. As shown in Figure 5, under the new forecast the long-term delivery capability of the SWP has been reduced 8 to 30 percent from the

2005 forecast.[4] The same forces impacting SWP long-term reliability are also expected to affect CVP delivery capability.

Recent developments in the SFPUC WSIP Program EIR process indicate that San Francisco may not meet forecasted 2030 purchase requests and therefore, SFPUC supplies in Santa Clara County would likely be below levels assumed in its most recent UWMP. Furthermore, SFPUC supplies to cities of San Jose and Santa Clara would likely continue to be temporary and interruptible after the contract renewal process is completed, which is expected to occur by June 2009. Any reductions in SFPUC supplies would likely result in increased demand and dependence on District supplies and increased groundwater pumping in Santa Clara Valley groundwater subbasin.

Figure 5. Updated SWP Delta Table A Delivery Probability Under Future Conditions



While imported supplies will always be an essential part of Santa Clara County's water supply, the IWRP Study 2003 emphasized that investment in new local resources is needed to decrease vulnerability to risk and minimize dry-year dependence on the Delta. Recent developments in the Delta have added urgency to this necessity. Conservation, water recycling, and desalination were identified as essential parts of a more diverse and flexible water supply for the long-term. These resources provide all-weather water supply for the County. Since all-weather supplies are available every year, they have the most predictability and certainty, and when combined with storage provide additional operational

4 Delivery amounts shown in Table 3 are for the entire SWP, not only Santa Clara County.

flexibility at reasonable cost. The best performing supply portfolios evaluated for IWRP Study 2003 included a combination of all-weather supplies, storage, and dry-year transfers. IWRP Study 2003 concluded all three types of supply would be necessary to meet future water needs.

2.6.3. Addressing Immediate and Long-term Risks to Supply Reliability

IWRP Study 2003 proposed a three-pronged approach to addressing the immediate and long-term risks to imported water supplies. The approach can be summarized as:

- Secure the Baseline
- Invest in "No Regrets" Projects to Improve Near-term Reliability
- Develop Flexible Options for the Long-term

Securing the baseline involves taking action to protect imported water supplies by working to resolve contract and policy issues, supporting Bay-Delta system improvements, resolving the San Luis Reservoir low-point problem, and supporting SFPUC efforts to implement a Regional Water System Improvement Program. Securing the baseline also involves expanding management and conjunctive use of Santa Clara County groundwater basins, which provide almost half the water supply to the County.

Investing in "No Regrets" projects means identifying and implementing cost-effective, environment-friendly, and flexible projects that can address near-term supply shortfalls and contribute toward long-term reliability goals. Such projects were termed "No Regrets" because their implementation is unlikely to be regretted later. IRWP Study 2003 called for the following three near-term "No Regrets" investments:

- 28,000 acre-feet of additional annual savings from municipal, industrial, and agricultural conservation to be fully realized by 2020.[5]
- 20,000 acre-feet of additional groundwater recharge capacity.
- 60,000 acre-feet of additional capacity in the Semitropic Water Bank

Lastly, the District committed itself to developing a more diverse and flexible supply portfolio for the long-term. While the District currently benefits from a relatively diverse water supply, it continues to pursue local options, such as expanded conservation, groundwater recharge, expanded groundwater emergency pumping, water recycling, desalination, and local and regional storage to promote greater resource diversity. Pursuing such supply diversity helps to minimize risk by reducing the reliance on imported supplies, which are becoming increasing vulnerable to risks from global warming, levee failure in the Delta, more stringent water quality standards and ESA protections, and the

5 The Strategic Plan modified the implementation schedule for "No Regrets" conservation due to cost considerations. The revised schedule generates 20,200 acre-feet of savings by 2020 and 28,500 acre-feet by 2030.

fate of CALFED program improvements, such as expansion of the Banks Pumping Plant. Adding new local water resources to the District's supply mix diminishes the exposure of Santa Clara County's overall water supply portfolio to these risks.

2.7. Water Use Efficiency's Role in Meeting District Reliability Objectives

The water conservation, water recycling, and desalination programs in the District's Water Use Efficiency (WUE) Program reduce demand on existing imported and groundwater supplies and assist the District in meeting its Board Ends Policy for water supply reliability, water conservation, and water recycling. The District Board's policies, in conjunction with the IWRP Study 2003 and the 2005 Urban Water Management Plan (UWMP), require that:

- Water conservation is implemented to the maximum extent that is practical
- Water recycling is expanded within Santa Clara County in partnership with the community
- A variety of water supply sources are available to minimize risk

Conservation and recycling are part of the District's baseline supply. The District expects to have saved 42,000 acre-feet per year by 2007 and 70,500 acre-feet per year by 2030 from both passive and active water conservation. Recycled water use as established in Board Policy is to reach 5 percent of total water use or 19,100 acre-feet by 2010 and 10 percent or 40,500 acre-feet by 2020. Current projections from existing recycled water facilities total 31,200 acre-feet per year by 2030. The District is exploring options for additional recycling to meet the Board targets including advanced recycled water treatment and use of that water for groundwater recharge and stream flow augmentation to further expand water recycling within Santa Clara County.

As discussed in the previous section, the IWRP Study 2003 identified an additional 28,000 acre-feet in conservation water savings by 2020 as a "No Regrets" investment in near-term reliability. This savings would be in addition to the baseline conservation savings of 70,500 acre-feet by 2030, thus bringing total conservation savings to 98,500 acre-feet by 2030.

3 Water Conservation Policies and Targets

3.1. Section Introduction

The District has been and continues to be a leader in water conservation with programs that are innovative and comprehensive in scope. As one of the initial signatories to the California Urban Water Conservation Council's (CUWCC) 1991 Memorandum of Understanding Regarding Urban Water Conservation in California (MOU), the District is committed to the implementation of both the wholesale and retail agency Best Management Practices (BMPs) shown in Sidebar 1.

Besides meeting long-term water reliability goals, water conservation programs help meet short-term demands placed on supply during critical dry periods. The District's IWRP Study 2003 identified a diversified water portfolio as an important element in meeting long-term water reliability, and recommends local programs such as water conservation to diversify future investments.

This section of the Strategic Plan summarizes the District's water conservation policies and targets as well as conservation's role in managing water shortages as envisioned by the District's Water Shortage Contingency Plan.

MOU Best Management Practices

BMP 1 (Retail)
Residential Surveys
BMP 2 (Retail)
Residential Plumbing Retrofit
BMP 3 (Retail & Wholesale)
System Water Audits, Leak Detection and Repair
BMP 4 (Retail & Wholesale)
Metering with Commodity Rates
BMP 5 (Retail)
Large Landscape Conservation Programs and Incentives
BMP 6 (Retail)
High Efficiency Washing Machine Rebate Programs
BMP 7 (Retail & Wholesale)
Public Information Programs
BMP 8 (Retail & Wholesale)
School Education Programs
BMP 9 (Retail)
Conservation Programs for Commercial, Industrial, and Institutional Accounts
BMP 10 (Wholesale)
Wholesale Agency Assistance Programs
BMP 11 (Retail)
Conservation Pricing
BMP 12 (Retail & Wholesale)
Conservation Coordinator
BMP 13 (Retail)
Water Waste Prohibitions
BMP 14 (Retail)
Residential Toilet Replacement Programs

3.2. Conservation Policies

District objectives and policies with respect to long-term water conservation and shortage management are embodied in various District policy statements and planning documents. At the broadest level, District Ends Policy 2.1.8 requires that:

- Water Conservation is implemented to the maximum extent that is practical.

The District interpretation of this policy statement requires that: [1]

- District conservation programs, projects and activities are implemented consistent with the most recent update of the District's Urban Water Management Plan; and
- Water conservation is promoted through District incentives, disincentives and in partnership and collaboration with local land-use entities to the maximum extent that is practicable in major new developments.

1 Governance Policies of the Board, Chapter V, CEO Interpretations.

The 2005 UWMP, the most recent update of the District's UWMP, commits the District to implementing, in partnership with the county's retail water agencies, the 14 BMPs contained in the MOU. As the water wholesaler for Santa Clara County, the District is directly responsible for implementing six of the BMPs (see Sidebar 1). The other BMPs apply to retail water agencies. However, at the request of its retailers, the District has taken the lead in implementing many of these retail BMPs through regional umbrella programs in which the county's retailers participate.

3.3. Long-Term Conservation Water Savings Targets

The District, using 1992 as a baseline, has targeted baseline conservation water savings of 70,500 acre-feet by 2030 from both passive and active water conservation. Passive water savings are water savings from water use efficiency codes that would be realized over time regardless of District or retail water agency conservation programs. Active water savings are water savings from conservation programs, such as the BMPs, implemented by the District and its retailers. On top of the baseline target, the IWRP Study 2003 identified an additional 28,000 acre-feet of savings by 2020 as part of the "No Regrets" reliability investments.[1]

The combined water savings targets in five-year increments are show in Table 4. These targets are for both passive and active water savings from all conservation activity in the county from 1992 to each year indicated in the table.

Table 4. District Water Savings Targets (1992 Baseline)

Year	2005	2010	2015	2020	2025	2030
2003 IWRP Baseline Conservation Program Savings (AF/Yr)	37,300	47,500	54,300	62,300	67,100	70,500
2003 IWRP "No Regrets" Conservation Savings (AF/Yr)*	0	3,400	9,800	20,200	24,100	28,000
Total Target (AF/Yr)	37,300	50,900	64,100	82,500	91,200	98,500

*Note that the implementation schedule for "No Regrets" conservation has been somewhat modified from the schedule presented in the 2005 UWMP in order to lower program implementation costs.

3.4. Shortage Management Objectives

The District's Water Shortage Contingency Plan describes actions that the District may take should water shortages occur. The current Water Shortage Contingency Plan derives from the District's April 2000 Draft Drought Management Plan.

The Strategic Plan is not intended to supplant or revise the District's existing Water Shortage Contingency Plan. Rather, the objective of the Strategic Plan,

1 The Strategic Plan modified the implementation schedule for "No Regrets" conservation due to cost considerations. The revised schedule generates 20,200 acre-feet of savings by 2020 and 28,500 acre-feet by 2030.

as it relates to shortage management, is to identify, quantify, and cost short-term demand management measures that could be implemented as part of the District's response to a water shortage. District responses to water shortages will be tailored to opportunities available at the time of the shortage. Potential responses include: voluntary water use reduction/public outreach (including media campaigns, increased water conservation literature and conservation kit distribution), followed by demand reduction measures or increased supplies.

The District's shortage response action guidelines do not specify the form of the drought response. Annual decisions, including whether to participate in the water market or call for demand cutbacks, are made through annual operations planning. However, the District has developed response thresholds based on the end-of-year groundwater basin carryover storage level. These response thresholds, shown in Table 5, indicate the magnitude, in acre-feet of additional water supply or demand reduction, of shortage response required.

In Section 7 of this report, potential demand management responses, water savings, and costs for shortage management are presented. This information is presented in the form of demand management shortage response curves for 2010, 2020, and 2030. These curves show the relationship between the amount of demand management achievable and the cost of achieving it. Response curves for the three periods were developed because the availability and cost of conservation measures change over the planning period in response to implementation of measures to achieve the long-term conservation water savings target. In essence, as one moves forward into the future, fewer conservation measures are available for management of emergency shortages because they have already been implemented as part of the long-term conservation plan. This dynamic affects both the cost and savings potential of conservation measures for shortage management.

Table 5. Shortage Response Action Guidelines[2]

Level	Expected End-of-Year Groundwater Basin Carryover Storage (TAF)	Response	Demand percent assuming 400 TAF Demand
--	350 to 530	No Action	-
1	320 to 350	Continue to monitor. Appropriate response (if any) to be determined	-
2	270 to 320	Implement 50 TAF response	12.5%
3	220 to 270	Implement 100 TAF response	25.0%
4	170 to 220	Implement 150 TAF response	37.5%
5	120 to 170	Implement 200 TAF response	50.0%
6	50 to 120	Implement 270 TAF response	62.5%

2 The Shortage Response Action Guidelines are undergoing review by the District. Analysis for the Strategic Plan is based on the current guidelines as shown in the table.

4 Overview of Current Conservation Programs

4.1. Section Introduction

As discussed above, the District has been implementing water conservation programs for many years. In addition to the District's extensive conservation programming efforts, code and market changes have caused many customers to install water-efficient fixtures and appliances. The conservation that results from these latter causes is termed 'naturally-occurring' or 'passive' conservation. This section of the Strategic Plan will describe the District's conservation efforts to date and the estimated water savings that have resulted from those efforts and from the naturally-occurring conservation that has occurred to date.

4.2. Historical Program Implementation

Every year, the District publishes its Water Use Efficiency Program Year End Report, which describes in detail the progress of the District's conservation programming efforts and the participation rates in each program. For each program that the District has implemented between the 1992-93 and 2006-07 fiscal years, Table 6 shows the annual participation rates. This table illustrates the aggressive nature of the District's efforts to date.

4.3. BMP Implementation and Compliance

The District is an original signatory of the MOU and has supported implementation of the 14 BMPs throughout Santa Clara County. As the water wholesaler for Santa Clara County, the District is responsible for the implementation of six of the BMPs (see Sidebar 1). It currently complies with each of these BMPs.[1] The District has also taken the lead in implementing many of the other BMPs for both the water retail agencies that are MOU signatories and those that are not.

A result of the District's proactive approach to retail BMP implementation has been a high level of retail BMP compliance at the county level. Table 7 shows the level of retail BMP compliance when assessed on a countywide basis. In several cases, District programs have propelled the county past MOU coverage requirements. This is the case for the multi family survey component of BMP 1, BMP 6 high efficiency clothes washer rebates, the CII toilet replacement component of BMP 9, and BMP 14 residential toilet replacement programs. The District's single-family residential survey program (BMP 1) has achieved a 76% compliance rate on a countywide basis. Likewise, its CII programs have achieved a 74% compliance rate with the BMP 9 water savings target. The county may have met the showerhead saturation requirement for BMP 2, though this would need to be confirmed through new surveys.[2] While countywide compliance with BMP 5 (large

1 As determined by the CUWCC through its BMP Reporting Database BMP Coverage Reports

2 The requirement to distribute low flow showerheads ends when the region achieves 75 percent saturation in pre-1992 residential construction. Surveys completed in 2003 showed saturation in Santa Clara County could be as high as 59 percent at a 95 percent level of statistical confidence and ±10 percent margin of error. The

landscape water conservation surveys and budgets) is currently low, the District is taking actions to change this. The District is in the process of implementing a comprehensive program for ETo- based water-use budgets for all large landscape sites by using aerial images and GIS techniques. The project acquired multi-spectral images of over 900 square miles of Santa Clara County, performed image analysis to identify the areas of turf, other landscaping, water features, bare ground and hardscape for each parcel (site) and prepared a database of these areas to support landscape water budgets. The District will routinely update each budget using ETo data from the California Irrigation Management Information System (CIMIS) so that the budgets reflect actual site irrigation demands during the most recent billing cycle. Concurrently, the District is developing a database-backed website (Water Budget Manager) to deliver real-time landscape water budget information to property and landscape managers via the internet. By offering monthly water budgets to all large landscape sites in the county the District will move the county into compliance with BMP 5.

It is important to note that the District is not obligated under the terms of the MOU to provide this level of assistance to its retail water customers. Rather, it reflects the District's historic commitment to the BMPs, its desire to help its retailers comply with the terms of the MOU, and the importance it assigns to local water supply development and demand management to diversify the County's water supply portfolio.

likelihood that a new survey with the same statistical confidence level as the 2003 survey, as prescribed by the MOU, would show compliance with BMP 2 is quite high.

Table 6. Conservation Programs: Historical Participation Rates

PROGRAMS	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	To-Date
Water Wise House Call: Audits SFD							377	771	1019	2125	2530	1567	1043	781	864	11,077
Water Wise House Call: Audits MFD							495	957	555	3273	958	824	2490	1130	1257	11,939
Showerhead Distribution	28000	13071	8785	7286	5429	4762	14688	7366	7243	13696	8025	6060	4495	2136	4366	135,408
Aerator Distribution				3040	6393	4540	6548	3388	9190	22463	17275	10095	6005	4189	11581	104,707
Residential Clothes Washer Rebates				21	306	2541	5345	4889	5011	6176	8942	8718	7737	9219	9433	68,338
SFD ULFT Rebate	2073	5802	12279	14755	12936	10719	17522	17750								93,836
MFD ULFT Rebate	7936	3669	3920	2837	6235	8968	19840	7871	683							61,959
CII ULFT Rebate Program		34	0	159	749	1067	2531	1362	139	112	35					6,188
SFD ULFT Distribution									2659	10957	158					13,774
MFD ULFT Distribution									1978	1030	3					3,011
SFD ULFT Full Install Program				975	11371	3711	11295	286	8572	6161	7846					50,217
MFD ULFT Full Install Program				1641	10899	15			1245	2641	4782					21,223
CII ULFT Full Install Program									460	799	1427	274	36			2,996
SFD HET rebate												24	63	135	375	597
MFD HET Rebate												0	1	11	27	39
HET Install Program for MFDs															1344	1,344
CII HET Install Program													989	1192	1793	3,974
CII HE Urinal Valve Retrofits															78	78
Mobile Home Submeter Installation Program									754							754
Water Softener Rebate Pilot												211	189			400
Water Softener Rebate Full Scale and SCRWA														40	10	50
Weather Based Controller Pilot Installation Program												125	51			176
Weather-Based Controller Installation Program														28	217	245
Weather-Based Controller Rebate Program																0
Water-Efficient Landscape Rebate (started as Pilot)														14	41	55
Irrigation Hardware Rebate Program (Resi)															0	0
Irrigation Hardware Rebate Program (CII)															2	2
Irrigation Tech Assistance to Large Landscapes			1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	
			69	78	71	33	61	76	64	47	81	72	63	70	67	852
WET: Rebates for process, technologies (#s)					7	10	7	4	10	5	0	10	10	6	2	71
WET: New annual savings (CCF/yr)					27,399	91,476	101,973	59,573	86,358	20,024	0	69,007	94,035	22,330	3,664	
WET: Savings per facility (afy)					9	21	33	34	20	9	0	13	22	9	4	
Pre-Rinse Spray Valve Installation Program											588	577	1503		1431	4,099
CII Washers								11	283	535	581	379	424	223	215	2,651
CII Surveys												26	18	12	45	101
Medical Equipment Rebates													0	3		3

Table 7. Countywide MOU Compliance by BMP

BMP	BMP Name	Coverage Requirement thru 2006/07[1]	% of Coverage Attained thru 2006/07[2]
1	Residential Surveys	SF: 33,000	76%[3]
		MF: 16,000	114%
2	Residential Plumbing Retrofits	Showerheads: 219,000	62%
3*	System Water Audits & Leak Repair	Annually complete pre-screen system audit; complete full audit whenever indicated by a pre-screening audit.	100%
4*	Metering with Volume Rates	Meter all customer connections	100%
5	Large Landscape Programs	Surveys: 3,000	28%
		Water Budgets: 90% of dedicated irrigation meter accounts in County (approx. 4,600 accts.)	0%
6	Clothes Washer Rebates	29,000 Rebate Points	236%
7*	Public Information	Implement a public information program to promote water conservation and water conservation related benefits	100%
8*	School Education	Implement a school education program to promote water conservation and water conservation related benefits.	100%
9	CII Conservation	CII Water Savings Target: 8,378 AFY	74%
		CII Toilets: 3% of savings potential by 2003/04	166%
10*	Wholesale Agency Assistance	Provide financial and technical support to retail water agencies in service area	100%
11	Conservation Pricing	Applies only to Retail Water Suppliers	NA
12*	Conservation Coordinator	Maintain the position of conservation coordinator and provide support staff as necessary	100%
13	Water Waste Ordinance	Adopt ordinances to prevent waste of water by retail water users	NA
14	Residential Toilet Replacement Programs	37,700 AF cumulative water savings by 2008	167%

BMP	BMP Name	Coverage Requirement thru 2006/07[1]	% of Coverage Attained thru 2006/07[2]

* BMP applies to wholesale water agencies.
1. Coverage requirements determined using the CUWCC BMP Coverage Calculator Version 1.7.
2. % of coverage attained thru 2006/07 based on implementation data in Table 6, CUWCC BMP coverage compliance reports for SCVWD, and program descriptions contained in the District's 2005 UWMP.
3. % of coverage includes residential surveys completed by San Jose Water Company as well as SCVWD surveys.

4.4. Naturally Occurring Conservation

Water demands in Santa Clara County have not only been reduced as a result of the District's own conservation programs, but also due to water savings that are associated with code- and market-driven forces. California urban water agencies, including the District, spearheaded many of these code requirements and market transformations through early adoption of technologies and support for key legislation.

Since 1992, water use efficiency codes have limited the replacement of several types of fixtures to water-efficient fixtures. These include:

- Toilets
- Showerheads
- Faucet aerators

In addition, while there are as yet no similar codes governing the replacement of residential clothes washers, it is assumed that a small percentage of replacements will in fact be water (and energy) efficient due to market forces.

Thus, when a conventional model of any of these fixtures reaches the end of its useful life or is replaced for another reason, the replacement will be water-efficient. As will be shown below, this 'natural turnover' of fixtures makes an important contribution to the District's overall water conservation savings.

The magnitude of the passive toilet savings is slated to increase due to the recent enactment of Assembly Bill 715. AB 715 mandates that, beginning in 2010, a portion of toilet replacements will be with so-called High Efficiency Toilets (HETs) rather than with the Ultra-Low-Flush Toilets (ULFTs), which have been mandated since 1992. This HET requirement will cover all toilet replacements beginning in 2014. Thus, beginning then, the savings associated with each toilet replacement is estimated to be 25% larger than the corresponding ULFT replacement. As will be discussed below, the advent of this new water-saving technology is also reflected in the future conservation programming being recommended by this Strategic Plan.

4.5. Estimated Water Savings from Historical Program Implementation and Naturally-Occurring Conservation

The District's conservation target in 2030 is 98,500 acre-feet, relative to a 1992 baseline. This target includes savings due to programmatic and passive savings in both existing and new construction. It includes two components: (1) baseline savings and (2) a 'No Regrets' increment. The 2003 IWRP estimated baseline water savings of 70,500 acre-feet by 2030 (see Table 4).

The Strategic Plan re-estimated baseline water savings to ensure that baseline and "No Regrets" water savings forecasts were derived from the same basic assumptions and model parameters, and to eliminate potential double counting of savings from certain programs. Re-estimation of baseline savings resulted in several adjustments, as follows:

- Baseline savings associated with toilet replacement programs were increased for two reasons:
  - The implementation of AB 715, which would result in natural replacement of conventional toilets with HETs rather than ULFTs. It would also lead to the natural replacement of already-installed ULFTs with HETs. Per the legislation, this change is phased in beginning in 2010, with full implementation expected by 2014.
  - The second, and larger, adjustment modifies the per-toilet savings to conform with the CUWCC BMP Cost & Savings Study, which are considerably larger than the savings assumptions originally used.
- Baseline savings associated with new (post-2007) activity from already existing conservation programs were removed to avoid overlap with the savings associated with activity from the new programs being proposed in this Strategic Plan. By so doing, the base was confined to savings due to past District programs, natural replacement, and new construction. All of the savings from additional activity from already existing programs as well as from new programs are thus reflected in the increment of savings beyond the base.
- Baseline savings associated with historical pre-rinse spray valve replacement programs, which were not reflected in the original base, were added to the base savings forecast.

The cumulative effect of these adjustments was a slight decrease in projected baseline savings to approximately 70,000 acre-feet by 2030, a difference of about 500 acre-feet. Table 8 shows projected base savings for years 2010, 2020, and 2030. Each year's savings is broken into the portion due to the District's historical conservation programming and the portion associated with natural replacement.

Table 8. Projected Water Savings Due to Past Conservation Programs and Naturally-Occurring Conservation (1992 Baseline)

End Use	2010 Water Savings (Acre-Feet)			2020 Water Savings (Acre-Feet)			2030 Water Savings (Acre-Feet)		
	Total	Program	Passive	Total	Program	Passive	Total	Program	Passive
Residential Toilets	26,330	5,837	20,492	35,913	5,837	30,076	40,899	5,837	35,062
Residential Washers	1,306	718	588	1,163	473	689	1,091	350	742
Residential Showers	6,175	353	5,822	7,046	353	6,693	7,218	353	6,866
Residential Faucets	3,736	113	3,622	3,966	113	3,852	3,968	113	3,855
Residential Leaks	1,481	1,481	--	2,335	2,335	--	2,796	2,796	--
Residential Landscape	591	591	--	1,015	1,015	--	2,245	2,245	--
CII (excluding toilets)	4,139	4,139	--	2,076	2,076	--	1,118	1,118	--
CII Toilets	5,618	196	5,421	7,867	196	7,671	8,929	196	8,733
Agricultural	1,000	1,000	--	1,000	1,000	--	1,000	1,000	--
Pre-Rinse Spray Valves	752	--	752	752	--	752	752	--	752
Total*	51,125	14,428 (28%)	36,697 (72%)	63,131	13,398 (21%)	49,733 (79%)	70,018	14,008 (20%)	56,010 (80%)

* Significant passive water savings have accrued since 1992. Most of this savings is associated with the replacement of existing inefficient toilets with ULFTs and the installation of ULFTs in new construction.

4.6. Additional Conservation Needed to Achieve District Target

With baseline savings of approximately 70,000 acre-feet by 2030, the District will need to develop an additional 28,500 acre-feet of "No Regrets" water savings by 2030 in order to reach its long-term savings target of 98,500 acre-feet -- 500 acre-feet more than the IWRP identified.

Previous analysis by the District has indicated that 6,000 acre-feet of savings would come from expansion of its current agricultural conservation program, leaving a residual of 22,500 acre-feet to come from new urban conservation programs. The revised 2030 baseline savings and division of "No Regrets" savings between agricultural and urban conservation programs are summarized in Table 9.

Table 9. Additional Urban Conservation Needed to Achieve District Target

Allocation of Long-Term Savings Target	2030 Water Savings (acre-feet)
Re-Estimated Base Water Savings	70,000
"No Regrets" Conservation Increment	
Continuation of Existing Agricultural Program	6,000
New Urban Conservation Programs	22,500
Total Savings/Long-Term Target	98,500

5 Evaluation of Potential Urban Conservation Programs

5.1 Section Introduction

To develop the mix of long-term urban conservation programs capable of producing 22,500 acre-feet of water savings by 2030, the District undertook a detailed evaluation of existing and new urban conservation programs. This section describes the process of identifying and evaluating these programs. This process included several steps:

- Identify universe of potential programs.
- Conduct qualitative screen of potential programs.
- Perform detailed economic analysis of programs that pass the qualitative screen.

The remainder of this section will discuss each of these steps in detail.

5.2 The Universe of Potential Urban Conservation Programs

Tables 10 and 11 show, respectively, the potential changes in existing programs, and the new programs that were considered by the Strategic Plan. These lists were intended to be all-inclusive so that all possibilities could be assessed. For each technology for which the District currently has one or more programs, Table 10 shows potential enhanced programming that was considered by the evaluation. For those technologies for which the District does not currently have a program, Table 11 suggests potential new programs.

A total of 61 different measures were identified, including:

- 13 measures affecting water use by single-family residences
- 17 measures affecting water use by multi-family residences
- 29 measures affecting commercial, industrial, and institutional water uses
- 2 measures affecting system efficiency and retailer rates

5.2.1 Ordinances and Regulatory Codes

It should be noted that the evaluation did not address the many potential conservation ordinances that might be implemented in Santa Clara County. This includes ordinances requiring particular conservation measures both for new construction and upon resale of existing construction. As a wholesale supplier, the District does not have the authority to enact such ordinances. Rather, they would have to be legislated by cities or the county. The exclusion of these measures therefore does not indicate their lack of importance but, rather, the legal and institutional constraints faced by the District. The District and its retail agencies

may want to consider working with cities and the county to add such ordinances to the county's menu of conservation programs.

Table 10. Universe of Potential Changes to Current Urban Conservation Programs

Category	Technology	Current or Past Programs	Potential Program Changes
SF Interior Existing Construction	Clothes Washers	Rebates	Add salesperson incentives
			Limited-term higher rebates *
			Retrofit on Resale (ROR) ordinance
	Toilets	HET Rebates	Limited-term higher rebates *
			Potential joint direct install program with PG&E.
			Direct Distribution Program (schools, special events, etc.)
SF Exterior Existing Construction	Landscape Design	Rebates	Broader set of efficient design rebates (not just cash-for-grass)
			Enhanced enforcement of Model Efficient Landscape Ordinance.
	Irrigation hardware	ITAP surveys Irrig. Hardware rebates WBIC rebates	Integrate two rebates
MF Interior Existing Construction	Clothes Washers	Rebates	Add salesperson incentives
			Limited-term higher rebates *
	Water softeners	Rebate	Operating restrictions, replacement incentives
	Toilets	HET Rebates HET Install	Direct Distribution Program (schools, special events, etc.)
			Limited-term higher rebates *
MF Interior Existing Construction	Clothes Washers	Rebates	Add salesperson incentives
			Limited-term higher rebates *
	Water softeners	Rebate	Operating restrictions, replacement incentives
	Toilets	HET Rebates HET Install	Direct Distribution Program (schools, special events, etc.)
			Limited-term higher rebates *

Category	Technology	Current or Past Programs	Potential Program Changes
MF Exterior Existing Construction	Landscape Design	Rebates	Broader set of efficient design rebates (not just cash-for-grass)
			Enhanced enforcement of Model Efficient Landscape Ordinance.
	Irrigation hardware	ITAP surveys Irrig. Hardware rebates WBIC rebates	Integrate two rebates
CII Interior Existing Construction	Toilets	HET Install	Target high-use industries *
	Urinals	Valve Retrofit	Direct installs
	Cooling towers	Rebates	Technical support & site inspections. Mandatory standards
	Clothes washers	Rebates	Re-examine rebate structure
			Piggyback onto existing energy utility program(s).
			Focus on industrial laundries
	Process	WET Rebates	Increase rebates
			Tie to CII surveys
			Enhanced marketing
	Various	Surveys	Target industries with high savings potential.
			Tie to WET
CII Exterior Existing Construction	Irrigation hardware	ITAP surveys Irrig. Hardware rebates WBIC rebates	Integrate two rebates
			Make available to smaller acreage (< 1 acre) w/o ITAP requirement
	LAMS	Water budgets	Link water budgets to financial incentives

* May be most appropriate for short-term use.

Table 11. Universe of Potential New Urban Conservation Programs

Category	Technology	Delivery Mechanism
SF Interior Existing Construction	Hot water recirculation	Rebate
SF Interior New Construction	Hot water recirculation	Rebate
	Clotheswashers	Rebate
	HET	Rebate
SF Exterior Existing Construction	Pool covers	Education Campaign
		Rebate
	Grey water	Rebate
SF Exterior New Construction	Irrigation	Rebate
	Design	Rebate
	Grey water	Rebate
MF Interior Existing Construction	Hot water recirculation	Rebate
	Submetering	Rebate
MF Interior New Construction	Water softeners	Rebate
	Hot water recirculation	Rebate
	Clotheswashers	Rebate
	Submetering	Rebate
	HET	Rebate
MF Exterior Existing Construction	Pool covers	Education Campaign
		Rebate
	Grey water	Rebate
MF Exterior New Construction	Irrigation	Rebate
	Design	Rebate
	Grey water	Rebate

Category	Technology	Delivery Mechanism
CII Interior Existing Construction	Hot water recirculation	Rebate
	Car wash recirculation	Rebate
	Dishwashers	Rebate
	Medical sterilizers	Rebate
	Food steamers	Rebate
	Cooling, refrigeration, ice makers	Rebate
CII Interior New Construction	Water softeners	Rebate
	Hot water recirculation	Rebate
	Clotheswashers	Rebate
	HET	Rebate
	Dishwashers	Rebate
	Medical sterilizers	Rebate
	Food steamers	Rebate
	Faucets (IR, spring-loaded)	Rebate
CII Exterior Existing Construction	Landscape design	Rebate
	Pool covers	Education Campaign
		Rebate
	Grey water	Rebate
CII Exterior New Construction	Irrigation	Rebate
	Design	Rebate
	Grey water	Rebate
	Metering	Financial incentive to install dedicated irrigation meters..
Miscellaneous	Distribution System	Retailer incentives for leak detection & repair
	Rates	Advice & tech assistance to retailers

5.3 Qualitative Screen of Potential Urban Conservation Programs

The programs listed in Tables 10 and 11 were subjected to a multi-criteria qualitative screen. The screening process was designed to identify those programs that were most appropriate for the District, which would then be analyzed in detail. For this purpose, six criteria were identified:

1. **Implementation feasibility.** Are the administrative, staffing, billing, institutional, legal, and/or political difficulties associated with implementing the program acceptable?
2. **Ability to quantify savings.** Can future program savings be forecast with a sufficient degree of certainty? Is the savings forecast sufficiently reliable?
3. **Customer/stakeholder acceptability.** Will the program be acceptable to District customers and/or other key program stakeholders?
4. **Utility match.** Is the technology well matched to the customers, appliance stocks, climate, building stock, and/or other characteristics of the service territory? (This criterion is only applicable to potential new programs.)
5. **Relationship to other programs.** Does the program duplicate, conflict with, and/or break continuity with other existing or proposed conservation programs?
6. **Anticipated water savings and costs.** Are the expected water savings from the program too small and/or the costs too large to make the program viable?

District staff evaluated each potential program against all of these criteria on a five-point scale (where 5 was the most favorable rating). A program was eliminated if at least two criteria were rated a '2' or at least one criterion had a rating of '1'. Staff then carefully examined the programs that passed the screen, and modified some of them to better conform to District experience.

The programs that emerged from this process are those whose potential savings and costs were examined in detail to determine how best to achieve the District's long-term conservation targets. The qualitative screen reduced the universe of conservation programs from 61 to 26. Table 12 summarizes the programs passing the qualitative screen. The detailed analysis of these programs and its results are described in the next section.

The results of the qualitative screen are presented in Appendix A.

Table 12. Conservation Programs Passing Qualitative Screen

Category	Technology	Program to be Evaluated
SF Interior	Clothes Washers	Rebates
	High-Efficiency Toilets	Rebates
SF Exterior: Large Landscapes	Landscape Design	Rebates
	Irrigation Equipment	Surveys and Rebates
	Weather-Based Irrigation Controllers	Rebates for Large Landscapes
SF Exterior: Small Landscapes	Irrigation Equipment and WBICs	Rebates
SF Exterior: New Construction	Irrigation Equipment	Rebates
MF Interior	Clothes Washers: In-Unit	Rebates
	Clothes Washers: Common Area	Rebates
	High-Efficiency Toilets	Direct Installation
	Submetering	Rebates for Existing and New Construction and Mobile Homes
MF Exterior	Landscape Design	Rebates
	Irrigation Equipment	Rebates for New Construction
CII Interior	High Efficiency Toilets	Direct Installation
	Clothes Washers	Rebates
	Industrial Process	Rebates
	Medical Sterilizers	Rebates
	Various	Surveys
	Food steamers	Rebates
CII Exterior	Landscape Design	Rebates
	Irrigation Equipment	Surveys and Rebates for Large Landscapes
	WBICs	Rebates for Large Landscapes
	Irrigation Equipment	Rebates for Small Landscapes
	WBICs	Rebates for Small Landscapes
	Various	Informational Budgets for Large Landscapes with Mixed Use and Dedicated Meters
Distribution System	Leak Detection & Repair	Incentives to Retail Agencies

5.4 Detailed Program Evaluation

Based on a search of the literature, studies by other water agencies, and the experience of the District, assumptions were developed for the following parameters for each program:

- The savings per unit (e.g. fixture, survey, participating customer, etc.) of program implementation, and the projected duration of those savings.
- The costs per unit that are incurred at the time of program entry (including administrative costs as well as customer rebates or other financial incentives), as well as ongoing per-unit and fixed annual costs that are expected to be incurred.
- Projected participation rates, that is, the number of units that are expected to enter the program each year.
- Expected rates of natural replacement and free-ridership.[1]

The resulting program assumptions are presented in Appendix B. These assumptions were used with the American Water Works Association Research Foundation's (AwwaRF) Benefit-Cost Model to forecast the annual savings and costs of each program. The projected savings and costs for each program were combined to calculate the unit cost associated with that program.

The unit cost measures how much the utility pays for each acre-foot of savings generated by the program over its life cycle. It is calculated by dividing the present value of the program costs by the present value of programmatic savings (i.e. savings which exclude expected natural replacement and free riders). Basing the unit cost on present values of costs and savings ensures that timing differences are properly accounted for and economic comparisons among programs are made appropriately.

Table 13 shows the unit costs benefit-cost ratios, and projected 2030 savings for the 26 programs passing the qualitative screen.

Unit costs shown in Table 13 do not account for possible cost-sharing or future grant funding the District may secure to help defray conservation program costs. Because future cost-sharing and grants are highly uncertain, they were excluded from the analysis. It is important to recognize, however, that future cost-sharing or grant funding could alter the cost ranking shown in Table 13.

1 Natural replacement reflects the effects of code requirements and/or market forces which results in a certain fraction of plumbing fixtures being replaced with water-conserving fixtures each year without utility intervention. Free riders are those customers who would have taken the conservation action targeted by the program without the program, but take advantage of the program's financial incentives. Both of these phenomena reduce the savings that can be attributed to the utility's active conservation program, but not to the overall physical water savings achieved.

Table 13. Conservation Program Units Costs, Benefit-Cost Ratios, and 2030 Water Savings

Class of Service	Program	Unit Cost ($/AF)	B/C Ratio	2030 Savings (AF)
SFD	HET Rebate	$533	1.17	3,369
SFD	Clotheswasher Rebate	$1,220	0.48	1,061
SFD	Landscape Rebate	$1,710	0.34	644
SFD (incl MFD)	Lg Landscape Survey & Hardware Rebate (excluding WBICs)	$263	2.19	302
SFD	WBIC Rebates for Large Landscapes	$157	3.65	1,233
SFD	Small Landscape Survey & Hardware Rebate (including WBICs)	$4,622	0.12	58
SFD	Irrigation Hardware Rebate for New Construction	$564	1.02	236
	SFD CLASS TOTAL	$735	0.81	6,903
MFD	HET Direct Install	$381	1.63	2,165
MFD	Clotheswasher Rebate: In-Unit	$3,045	0.19	120
MFD	Clotheswasher Rebate: Common Area	$1,083	0.54	83
MFD	Landscape Rebate	$1,328	0.43	339
MFD	Irrigation Hardware Rebate for New Construction	$236	2.45	52
MFD	Submetering: Existing Construction	$398	1.61	1,292
MFD	Submetering: New Construction	$285	2.23	94
MFD	Submetering: Mobile Homes	$124	4.53	140
	MFD CLASS TOTAL	$547	1.13	4,285
CII	HET Direct Install (high-use sectors)	$439	1.40	450
CII	HET Direct Install (low-use sectors)	$933	0.66	582
CII	Clotheswasher Rebate	$508	1.16	607
CII	Industrial Process	$272	2.04	442
CII	Medical Sterilizers - Condensate	$134	4.59	140
CII	Medical Sterilizers - Ejector	$301	2.05	195
CII	Food Steamers	$1,003	0.59	76
CII	Landscape Rebate	$1,326	0.43	95
CII	Lg Landscape Survey & Hardware Rebate (excluding WBICs)	$259	2.22	603
CII	WBIC Rebates for Large Landscapes	$158	3.63	1,409
CII	Small Landscape Hardware Rebate (excluding WBICs)	$1,015	0.57	66
CII	WBIC Rebates for Small Landscapes	$1,059	0.54	48
CII	Lg Lndscp Budget -- Mixed Meter	$9	71.14	5,121
	Lg Lndscp Budget -- Dedicated Meter	$14	46.75	4,843
CII	Leak Det & Repair Incentives	$238	2.58	1,731
	CII CLASS TOTAL	$131	4.76	16,410
	GRAND TOTAL	$369	1.66	27,598

6 Long-Term Conservation Plan

6.1 Section Introduction

A key objective of the Strategic Plan is to determine how the District can achieve its long-term conservation target in as economical a manner as possible. This section evaluates how the programs passing the qualitative screen described in Section 5 can be combined into a least-cost conservation plan capable of achieving the long-term savings target.

6.2 Least-Cost Conservation Programs

The least-cost conservation plan can be determined by ranking the conservation measures from low to high cost and, starting with the lowest cost programs, adding additional programs until the conservation target is reached. This process is depicted in Table 14, where programs above the shaded region of the table represent the set of least-cost measures capable of achieving the long-term conservation target. Figure 6, depicts this information graphically in the form of a conservation water supply curve. This supply curve shows the marginal cost of the set of conservation programs needed to reach the District's long-term target. This marginal cost is just over $530/AF. The average unit cost across all programs included in the plan is $210/AF.

6.2.1 Impact of Cost-Sharing on Recommended Programs

The unit costs shown in Table 14 and used to generate Figure 6 include all expected program administration and financial incentive outlays, but ignore the impacts of potential cost sharing arrangements. Because current grant funding and cost-sharing arrangements will expire over the next few years, and because future cost-sharing and grant funding is unpredictable, this source of program funding was excluded from the analysis. As a result, some current District programs, which are being funded in part by cost-sharing partners, are not part of the least-cost set of conservation measures listed in Table 14.[1] These programs should be continued as long as cost-sharing continues.

In general, programs that secure cost sharing will become part of the least-cost set of "No Regrets" conservation programs provided they have a unit cost after accounting for cost-sharing that is below about $530/AF.[2] For the conservation programs in the gray region of Table 14, Table 15 shows the amount of cost-sharing required to make a program break even (B/C ratio = 1) and the amount required to include it in the set of least-cost "No Regrets" programs (Unit Cost

1 These programs include landscape rebates for SFD, MFD, and CII customers, small landscape surveys and hardware rebates, and MFD common-area clothes washer rebates.

2 While this is true in general, it should be noted that if the marginal program in the least-cost "No Regrets" set of programs, which currently is the SFD HET Rebates program, also is partially paid for with grant funding, this would lower the marginal cost of the plan to below $530/AF.

= $530/AF). For example, single-family irrigation hardware rebates for new construction are estimated to cost, on average, $168/site. This measure already has a B/C ratio greater that 1.0, thus no cost-share is required to make the measure break-even. In order for the measure to qualify as a member of the least-cost set of conservation programs capable of achieving the District's long-term target, however, a cost-share of at least $10/site is required. This cost-share would reduce the unit cost of water to $530/AF. Similarly, the HET direct install program for low water use CII sectors would require a cost-share of $89/toilet to make the program break-even and a cost-share of at least $113/toilet to make the program part of the least-cost set of "No Regrets" conservation programs.

Table 14. "No Regret" Urban Conservation Programs, Sorted from Low to High Cost*

Class of Service	Program	Unit Cost ($/AF)	B/C Ratio	2030 Savings (AF)	Cumulative Savings (AF)
CII	Lndscp Budget - Mixed Meter**	$9	71.14	5,121	5,121
CII	Lndscp Budget – Ded. Meter**	$14	46.75	4,843	9,963
MFD	Submetering: Mobile Homes	$124	4.53	140	10,103
CII	Medical Sterilizers - Condensate	$134	4.59	140	10,244
SFD	WBIC Rebates for Lrg Lndscp	$157	3.65	1,233	11,477
CII	WBIC Rebates for Lrg Lndscp	$158	3.63	1,409	12,886
MFD	Irr. Equip. Rebate for New Constr.	$236	2.45	52	12,938
CII	Leak Det & Repair Incentives	$238	2.58	1,731	14,669
CII	Lg Lndscp Srvy & Equip. Rebate	$259	2.22	603	15,272
SFD/MFD	Lg Lndscp Srvy & Equip. Rebate	$263	2.19	302	15,574
CII	Industrial Process	$272	2.04	442	16,016
MFD	Submetering: New Construction	$285	2.23	94	16,110
CII	Medical Sterilizers - Ejector	$301	2.05	195	16,305
MFD	HET Direct Install	$381	1.63	2,165	18,470
MFD	Submetering: Existing Constr.	$398	1.61	1,292	19,762
CII	HET Install (high-use sectors)	$439	1.40	450	20,212
CII	Clotheswasher Rebate	$508	1.16	607	20,819
SFD	HET Rebate	$533	1.17	3,369	24,188
SFD	Irr. Equip. Rebate for New Constr.	$564	1.02	236	24,425
CII	HET Install (low-use sectors)	$933	0.66	582	25,007
CII	Food Steamers	$1,003	0.59	76	25,084
CII	Small Lndscp Equip. Rebate (excluding WBICs)	$1,015	0.57	66	25,149
CII	WBIC Rebates for Small Lndscp	$1,059	0.54	48	25,198

Class of Service	Program	Unit Cost ($/AF)	B/C Ratio	2030 Savings (AF)	Cumulative Savings (AF)
MFD	Washer Rebate: Common Area	$1,083	0.54	83	25,281
SFD	Washer Rebate	$1,220	0.48	1,061	26,342
CII	Landscape Rebate	$1,326	0.43	95	26,437
MFD	Landscape Rebate	$1,328	0.43	339	26,776
SFD	Landscape Rebate	$1,710	0.34	644	27,420
MFD	Washer Rebate: In-Unit	$3,045	0.19	120	27,540
SFD	Small Lndscp Srvy & Equip. Rebate (including WBICs)	$4,622	0.12	58	27,598

*Programs above the shaded region constitute the least-cost set of programs capable of achieving the District's long-term conservation target. Unit costs in the table do not account for cost-sharing and grant funding, and thus some grant-funded programs currently operated by the District are not part of the least-cost set of "No Regrets" conservation programs. In general, programs that secure cost sharing will become part of the least-cost set of "No Regrets" conservation programs listed in this report provided the cost-sharing results in a unit cost of $530/AF or less.

**Unit costs for landscape budgets are based on assumptions about unit costs, acres/site, usage per acre, and savings percentages developed by District landscaping consultants and result in very low cost water savings potential.

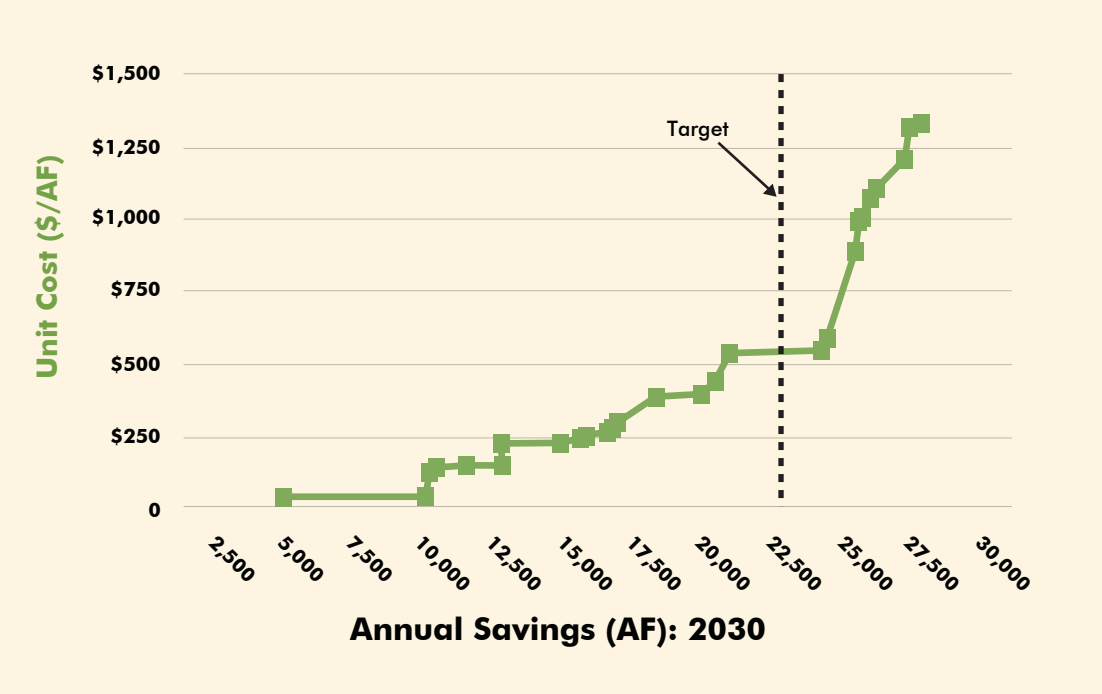
Table 15. Cost-Sharing Needed to Be in List of Least-Cost "No Regrets" Programs

Class	Conservation Program	Units	District Avg. Cost Per Unit of Activity 1/	Required Per Unit Cost-Share for B/C=1 2/	Required Per Unit Cost-Share for Unit Cost=$530/AF 3/
SF	Irrigation Hardware Rebate for New Construction	Sites	$168/Site	$0/Site	$10/Site
CII	HET Direct Install (low-use sectors)	Toilets	$260/Toilet	$89/Toilet	$113/Toilet
CII	Food Steamers	Steamers	$3,095/ Steamer	$1,261/ Steamer	$1,458/ Steamer
CII	Small Landscape Hardware Rebate (excluding WBICs)	Sites	$522/Site	$237/Site	$263/Site
CII	WBIC Rebates for Small Landscapes	Sites	$752/Site	$345/Site	$376/Site
MFD	Clotheswasher Rebate: Common Area	Washers	$484/washer	$225/washer	$247/washer
SFD	Clotheswasher Rebate	Washers	$195/washer	$101/washer	$109/washer
CII	Landscape Rebate	Rebate/ Sqft	$1.11/Sqft	$0.63/Sqft	$0.67/Sqft

Class	Conservation Program	Units	District Avg. Cost Per Unit of Activity 1/	Required Per Unit Cost-Share for B/C=1 2/	Required Per Unit Cost-Share for Unit Cost=$530/AF 3/
MFD	Landscape Rebate	Rebate/ Sqft	$1.11/Sqft	$0.63/Sqft	$0.67/Sqft
SFD	Landscape Rebate	Rebate/ Sqft.	$1.43/Sqft	$0.95/Sqft	$0.99/Sqft
MFD	Clotheswasher Rebate: In-Unit	Washers	$194/washer	$156/washer	$159/washer
SFD	Small Landscape Survey & Hardware Rebate (including WBICs)	Sites	$95/Site	$83/Site	$84/Site

Notes:
1. Avg. cost per unit of activity includes all expected District administration and financial incentive outlays.
2. Changes in administrative costs, level of incentive, program design and other factors can also impact the B/C ratio.
3. This column shows the level of cost-share per unit of activity required to lower the activity's unit cost of water savings to the threshold cost of $530/AF.

Figure 6. "No Regrets" Urban Conservation Supply Curve: 2030



6.3 Annual Activity Levels and District Costs

Average annual activity levels for each least-cost "No Regrets" program included in the long-term plan are shown in Table 16.[3] Activity levels were based on a number of considerations, including:

- Amount of program savings required to reach the long-term target
- District staffing and outsourcing capability
- Market potential and level of market saturation
- Historical program experience

As the plan is implemented activity levels may require adjustment according to results. If activity levels for some programs prove too aggressive they may need to be scaled down and other programs may need to be scaled up or additional programs may need to be added to the plan. Similarly, if some programs exceed their projected activity level, this may allow other programs to be downsized.

Table 17 shows the expected annual District expenditure to implement the long-term plan based on the activity levels shown in Table 16. Annual program costs are shown for 2010, 2015, and 2020 and account for all program-specific administrative and financial incentive expenditure. Annual costs average approximately $4.2 million per year (2007 constant dollars). Because these costs

3 Actual activity levels for some programs 'ramp up' in the initial program years. Thereafter, the activity levels for many programs fluctuate from year to year. Except where otherwise noted, the figures in Table 16 represent the average annual activity level over the planning period.

do not assume any grant funding or cost-sharing, they constitute an upper-bound annual cost estimate for the long-term plan.

Under the current set of least-cost "No Regrets" programs, approximately 39 percent of annual District expenditure for urban conservation would go to single-family residential programs, 26 percent would go to multi-family residential programs, and 35 percent would go to CII conservation programs. About 16 percent of program expenditure would be for landscape conservation programs. The remaining 84 percent of program expenditure would be for indoor conservation, submetering, and leak detection programs. Landscape conservation programs' relatively low share of total expenditure belies the contribution these programs make to total water savings. The mixed- and dedicated-meter landscape budget programs are, by a wide margin, the most cost-effective programs in the long-term plan and account for 41 percent of 2030 projected water savings. The low share of total annual expenditure going to landscape conservation is explained by the cost-effectiveness of these two programs.

Table 16. "No Regrets" Urban Conservation Plan Annual Activity Levels

Class of Service	Program	Units	Avg. Annual Activity
SFD	HET Rebate	Rebates	8,360
SFD	Lg Landscape Survey & Hardware Rebate (excluding WBICs)	Rebates	40
SFD	WBIC Rebates for Large Landscapes	Rebates	175
MFD	HET Direct Install	Toilets	2,500
MFD	Irrigation Hardware Rebate for New Construction	Rebates	20
MFD	Submetering: Existing Construction	MF dwelling Units	2,300
MFD	Submetering: New Construction	MF dwelling Units	170
MFD	Submetering: Mobile Homes	Mobile homes	500*
CII	HET Direct Install (high-use sectors: schools, restaurants, retail-wholesale)	Toilets	600
CII	Clotheswasher Rebate	1,000 lbs/yr	12,000
CII	Industrial Process	Sites	5
CII	Medical Sterilizers - Condensate	Rebates	5
CII	Medical Sterilizers - Ejector	Rebates	5
CII	Lg Landscape Survey & Hardware Rebate (excluding WBICs)	Surveys	80
CII	WBIC Rebates for Large Landscapes	Rebates	200
CII	Lg Lndscp Budget -- Mixed Use	Budgets	242
	Lg Lndscp Budget -- Dedicated	Budgets	358
CII	Leak Det & Repair Incentives	AF/Yr	171
CII	General Surveys	Surveys	50
* Through 2012, zero thereafter.			

Table 17. "No Regrets" Urban Conservation Plan Annual Cost (Million Dollars/Yr)*

Class of Service	Program	Annual Cost: 2010	Annual Cost: 2015	Annual Cost: 2020
SFD	HET Rebate	1.42	1.42	1.42
SFD	Lg Landscape Survey & Hardware Rebate (excluding WBICs)	0.06	0.06	0.06
SFD	WBIC Rebates for Large Landscapes	0.17	0.17	0.17
	SFD CLASS TOTAL	1.65	1.65	1.65
MFD	HET Direct Install	0.66	0.66	0.66
MFD	Irrigation Hardware Rebate for New Construction	0.01	0.01	0.01
MFD	Submetering: Existing Construction	0.36	0.39	0.42
MFD	Submetering: New Construction	0.02	0.02	0.02
MFD	Submetering: Mobile Homes	0.06	0.00	0.00
	MFD CLASS TOTAL	1.12	1.08	1.11
CII	HET Direct Install (high-use sectors: schools, restaurants, retail-wholesale)	0.16	0.16	0.16
CII	Clotheswasher Rebate	0.26	0.25	0.25
CII	Industrial Process	0.11	0.11	0.11
CII	Medical Sterilizers - Condensate	0.01	0.01	0.01
CII	Medical Sterilizers - Ejector	0.04	0.04	0.04
CII	Lg Landscape Survey & Hardware Rebate (excluding WBICs)	0.12	0.12	0.12
CII	WBIC Rebates for Large Landscapes	0.20	0.20	0.20
CII	Lg Lndscp Budget -- Mixed Use	0.04	0.04	0.04
	Lg Lndscp Budget -- Dedicated	0.06	0.05	0.05
CII	Leak Det & Repair Incentives	0.34	0.34	0.34
CII	General Surveys	0.13	0.13	0.13
	CII CLASS TOTAL	1.47	1.46	1.46
	GRAND TOTAL	$4.24	$4.19	$4.22

*Annual District costs include all program-specific overhead and administrative cost but exclude fixed District staff costs. Costs also exclude consideration of future grant funding or cost sharing agreements with the state or other entities.

6.4 2030 Estimated Water Savings

The recommended programs will enable the District to achieve its 2030 conservation target.4 Table 18 shows the contribution of the active and passive savings of each program to the 2030 savings goals.

The least-cost set of "No-Regrets" urban conservation programs save approximately 24,200 AFY by 2030, about 1,700 AFY more than required assuming agricultural programs would save an additional 6,000 AFY.

Table 18. 2030 Active and Passive Conservation (AFY)

Customer Class	Active Savings				Passive Savings		Grand Total
	Baseline	New Programs	Total	% of Target	Baseline	% of Target	
Residential	11,693	8,647	20,340	21%	46,524	47%	66,865
CII	1,314	15,541	16,855	17%	9,485	10%	26,341
Agriculture	1,000	4,295*	5,295	5%		0%	5,295
Total	14,008	28,483	42,490	43%	56,010	57%	98,500

*Residual amount of water savings required to achieve conservation target by 2030.

6.5 MOU Compliance

As discussed in Section 4.3, the District currently complies with the six BMPs that apply to wholesale water agencies.5 Additionally, the District's regional conservation programs have resulted in a high level of retail BMP compliance when assessed on a countywide basis, with the exceptions of BMP 5 (Large Landscape Programs) and BMP 9 (CII Conservation Programs). In addition to meeting the District's own long-term conservation targets, this plan will allow the county to achieve full compliance with both of these BMPs by no later than 2020.

Table 19 shows expected compliance dates for each BMP based on the conservation program implementation levels of this plan.

4 The savings associated with the programs include both active (programmatic) and passive (natural replacement, free riders) savings. The active savings, which result from baseline programs as well as the programs being recommended in this Strategic Plan, comprise approximately 40% of the total projected 2030 savings. The remaining 60% comes from passive savings.

5 The BMPs are currently undergoing revision. The revision process may result in new or modified BMP requirements. The District, a signatory to the MOU and an active CUWCC member, is actively participating the revision process. The compliance analysis conducted for this Strategic Plan is based on the current set of BMPs.

Table 19. Projected Countywide MOU Compliance by BMP

BMP No.	BMP Name	Full Coverage Requirement[1]	Projected Year Full Coverage Attained[2]
1	Residential Surveys	SF: 52,000 MF: 24,000	2017
2	Residential Plumbing Retrofits	75% LF Showerhead Saturation	2010[3]
3*	System Water Audits & Leak Repair	Annually complete pre-screen system audit; complete full audit whenever indicated by a pre-screening audit.	Already Attained
4*	Metering with Volume Rates	Meter all customer connections	Already Attained
5	Large Landscape Programs	Surveys: 4,200	2010 if budget program for mixed-use meters implemented[4]
		Water Budgets: 90% of dedicated irrigation meter accounts in County (approx. 4,600 accts.)	2020
6	Clothes Washer Rebates	29,000 Rebate Points	Already Attained
7*	Public Information	Implement a public information program to promote water conservation and water conservation related benefits	Already Attained
8*	School Education	Implement a school education program to promote water conservation and water conservation related benefits.	Already Attained
9	CII Conservation	CII Water Savings Target: 11,782 AFY	2015
		CII Toilets: 3% of savings potential by 2003/04	Already Attained
10*	Wholesale Agency Assistance	Provide financial and technical support to retail water agencies in service area	Already Attained
11	Conservation Pricing	Applies only to Retail Water Suppliers	NA
12*	Conservation Coordinator	Maintain the position of conservation coordinator and provide support staff as necessary	Already Attained
13	Water Waste Ordinance	Adopt ordinances to prevent waste of water by retail water users	NA
14	Residential Toilet Replacement Programs	37,700 AF cumulative water savings by 2008	Already Attained

* BMP applies to wholesale water agencies.
1. Coverage requirements determined using the CUWCC BMP Coverage Calculator Version 1.7.
2. Projected year of full coverage based on implementation data in Table 6, CUWCC BMP coverage compliance reports for SCVWD, and projected conservation program activity contained in this Strategic Plan.
3. Based on survey results and predicted year of 75% saturation reported in Santa Clara County Residential Water Use Baseline Survey: Final Report, 2004.
4. Per the MOU, a program that assigns landscape water budgets to mix-use CII sites automatically satisfies BMP 5's landscape survey requirement.

7 Shortage Management Responses, Savings, and Cost

7.1 Section Introduction

As discussed in Section 3.4, District shortage management response is linked to the end-of-year storage in regional groundwater basins. Decreasing levels of end-of-year storage trigger increasing levels of shortage response. The level of response is expressed in terms of the acre-feet of supplemental water supply or demand management required to address the shortage. The indicated response is intended to be flexible and will be tailored to opportunities available at the time. Potential responses include: voluntary water use reduction/public outreach (including media campaigns, increased water conservation literature and conservation kit distribution), followed by demand reduction measures or increased supplies. The shortage response action guidelines do not specify the form of the drought response. Annual decisions, including whether to participate in the water market or call for demand cutbacks, are made through annual operations planning.

This section describes potential demand management responses available to the District, savings potential of these responses, and their expected cost. Demand management responses would be incremental to the implementation of long-term conservation measures described in Section 6. The Strategic Plan evaluated three types of demand management response. These were:

- Public Information and Outreach
- Conservation Measures and Programs; and
- Mandatory Restrictions and Price-Induced Conservation

Shortage response potential is presented in the form of demand management shortage response curves for 2010, 2020, and 2030. These curves show the relationship between the amount of demand management achievable and the cost of achieving it. Response curves for the three periods were developed because the availability and cost of conservation measures change over the planning period as a consequence of implementation of measures to achieve the long-term conservation water savings target. In essence, as one moves forward into the future, fewer conservation measures are available for management of emergency shortages because they have already been implemented as part of the long-term conservation plan. This dynamic affects both the cost and savings potential of conservation measures for shortage management over time.

7.2 Public Information and Outreach

The District uses public information and outreach to inform the public on issues affecting the availability, reliability, quality and cost of Santa Clara County's water supply. Public information and outreach is a core part of the District's long-term

water conservation program as well as a key policy instrument for managing temporary water shortages.

To help meet its long-term water conservation targets, the District operates an extensive public information program and associated schools program which provide materials, speakers and outreach activities to the general public. The District employs a professional staff to provide outreach related to water conservation, urban runoff pollution, water recycling, watershed and flood protection and water quality. Outreach activities include publications and Web site development, public meetings, District participation at community events, multi-media campaigns, inter-agency partnerships, corporate environmental fairs, professional trade shows, water conservation workshops and seminars and a speaker's bureau. In the spring of each year (and extending through the fall), an extensive campaign emphasizing the importance of water conservation is conducted.

Public information and outreach is typically one of the first responses implemented by the District when confronting a pending or existing water shortage. In the context of a water shortage, the District uses public information and outreach to alert the public to the need to reduce water use and to provide information and tips on how this can be accomplished at low cost and with minimal inconvenience.

7.2.1 Empirical Evidence of Water Savings Potential

The effectiveness of public information and outreach, both in promoting long-term conservation and addressing temporary shortages, has proven hard to measure. Partly this is because public information and outreach is typically run concurrently with other demand management programs making it difficult to disentangle the various policies and programs affecting water use. Also, there is no one standard model for public information and outreach. Public information programs can vary dramatically among water agencies in terms of structure, content, and funding.

Reviewed literature summarized in Appendix C suggests that public information campaigns, appeals for conservation, and voluntary measures are, in most cases, mildly to moderately effective at reducing water use, and in some cases, highly effective. A comprehensive review of the literature by Syme, et al. (2000) concluded that education campaigns could result in significant (up to 25 percent) water savings in short-term or crisis situations. Estimates of the effectiveness of voluntary conservation measures during the 1987-92 California drought by Hanemann and Nauges (2005) and by Renwick and Green (2000), were more modest, clustering between 5 and 10 percent of average household demand.

This more moderate savings range also is supported by water use data from the 1987-92 California drought compiled by RAND (1996). Table 20 shows the average change in water use relative to 1986 for the years 1987 through 1991 for water agencies in the Bay Area, Southern California, and Rest of California. For most water agencies outside of the Bay Area, mandatory water use restrictions were not imposed until 1990 or 1991. Prior to this time, water agencies implemented public information campaigns and called for voluntary conservation.

In the Bay Area, mandatory restrictions began earlier. By 1989, many Bay Area water agencies had adopted mandatory or price-based restrictions on water use. In 1987, however, most agencies in the Bay Area were still relying on public information campaigns and voluntary conservation. As seen in the table, during the periods in which information campaigns and calls for voluntary conservation predominated, reductions in water use averaged between 5 and 10 percent in the Bay Area and Rest of California. In Southern California, where supplies from the Colorado River, surface storage, and regional groundwater helped offset the effects of the drought, reductions in use did not begin in earnest until 1991.[1]

Table 20. Average Percentage Change in Per Capita Water Use Relative to 1986

Year	Bay Area (N = 12)	So. California (N = 28)	Rest of CA (N = 13)	All Agencies (N = 53)
1987	4%	-1%	-2%	-4%
1988	-8%	0%	-4%	-8%
1989	-15%	2%	-6%	-8%
1990	-13%	-1%	-10%	-10%
1991	-23%	-17%	-18%	-22%

Notes:
N equals the number of water agencies in the sample
Percentage change in per capita water use relative to 1986 per capita water use.

7.2.2 Behavioral Response Analysis

The magnitude of water savings resulting from informational campaigns reported in the literature was compared to an estimate of water savings potential resulting from behavioral responses to calls for voluntary conservation. The behavioral response analysis considered typical water use behavioral changes and resulting water savings for residential end uses of water. Baseline residential end use estimates were taken from the AWWARF Residential End Uses of Water Study (REUWS). The results are shown in Table 21.

1 By 1991 California and especially Southern California was in broad economic recession, which would also have contributed to the sharp reductions in water use observed in 1991.

Table 21. Potential Residential Behavioral Responses to Calls for Voluntary Conservation

Residential End Use	Baseline GPCD 1/	Behavioral Response 2/	Savings Potential 3/	Revised GPCD	Share of Savings
Dishwasher	1.0	Only run full loads	10.0%	0.9	0.3%
Bath	1.2	None posited	0.0%	1.2	0.0%
Other Domestic	1.6	None posited	0.0%	1.6	0.0%
Leak	9.5	Repair most obvious leaks	25.0%	7.1	8.1%
Faucet	10.9	Don't leave running during tasks	10.0%	9.8	3.7%
Shower	11.6	5 min showers	37.5%	7.3	14.9%
Clothes Washer	15.0	Only run full loads	10.0%	13.5	5.1%
Toilet	18.5	Reduce Flushing by 1/4	25.0%	13.9	15.9%
Outdoor	100.8	Reduce watering frequency/duration	15.0%	85.7	51.9%
Unknown	1.7	None posited	0.0%	1.7	0.0%
Total	171.8		17.0%	142.6	100.0%

Notes:
Baseline GPCD estimates from AWWARF Residential End Uses of Water Study and are based on data logging of 1,188 single-family homes.
Behavioral responses based on common water savings actions taken by residential water users during periods of water shortage.
Savings potential based on professional judgment.

The water savings potentials for the residential end uses shown in Table 20 assume only changes in water using behavior. They are not predicated on changes in water using hardware or appliances.[2] Total savings potential from simple behavioral responses is 17 percent of baseline residential water use. Outdoor water uses account for nearly 52 percent of estimated water savings potential. Other significant sources of water savings are (1) reduced toilet flushing, (2) shorter showers, and (3) leak repair. Together, these three end uses account for about 39 percent of potential water savings, and comprise the greatest opportunities for temporarily reducing indoor water use.

The behavioral response analysis suggests the potential for significant water savings in the residential sector through behavioral changes alone. Total potential

2 As will be subsequently shown, this is important because as water using hardware and appliances become more efficient over time as a result of investment in long-term conservation, the savings potential from behavioral responses will decrease to some extent.

in the residential sector is significantly above empirical estimates of water savings from voluntary conservation campaigns reviewed in the previous section. This is to be expected for two reasons. First, the reviewed empirical data is based on all water uses, not just residential. Commercial and industrial water uses, because of their linkages to business activity and production processes, may be less susceptible to behavioral modification. Second, Table 21 does not account for non-responsive residential water users. That is, not all residences can be expected to take these actions. Once one averages over responsive and non-responsive households, the expected level of savings would decrease.

The level of responsiveness by residential water users and other customer classes depends on many factors. Two key considerations are the intensity of the informational campaign calling for voluntary conservation and the public perception regarding the water emergency. The first can drive the second in the sense that increased calls for conservation can heighten public perception of a water emergency and also provide information on how to respond to it. But other forces drive public perception as well, such as the duration of the shortage; whether the shortage is the result of easily observable phenomena, such as a prolonged dry period, versus less obvious causes, such as regulatory intervention or disruption to infrastructure; whether neighboring communities are also being affected; and whether the general media is reporting the story. Generally, but not always, as the shortage lengthens and deepens, growing public awareness of the need to curtail water use increases the level of customer responsiveness to calls for water conservation.

In Table 22, savings potential from behavioral responses are hypothesized for each customer class, as well as a reasonable range of responsiveness to expect within each class. End uses for non-residential customer classes, other than dedicated landscape, are too heterogeneous to analyze at the end use level, as was done for residential water uses in Table 21. Instead, reasonably conservative estimates of savings potential and conservation responsiveness are posited for these sectors based on evidence from the 1987-92 drought compiled by RAND (1996). Table 22 suggests that plausible levels of behavioral savings potential and customer responsiveness result in levels of water savings consistent with empirical estimates of voluntary water savings reviewed in the previous section.

Table 22. Water Savings from Behavioral Potential and Customer Responsiveness

Customer Class	Behavioral Potential 1/	Customer Responsiveness 2/		% Water Savings	
		Lower	Upper	Lower	Upper
SF Residential	17%	50%	70%	8.5%	11.9%
MF Residential	10%	40%	60%	4.0%	6.0%
Commercial	10%	40%	60%	4.0%	6.0%
Industrial	10%	40%	60%	4.0%	6.0%
Institutional	15%	50%	75%	7.5%	11.3%
Government	15%	50%	75%	7.5%	11.3%
Landscape	10%	50%	75%	5.0%	7.5%
		Wtd. Average 3/		6.0%	8.7%

Notes:
Behavioral potential for SF Residential from Table 20. Behavioral potential for other customer classes based on professional judgment.
Customer responsiveness based on evidence from 1987-92 drought and professional judgment.
Customer class shares of total water use in Santa Clara County, as reported in the 2005 UWMP used to compute weighted average water savings.

7.2.3 Public Information Expenditure and Water Savings Potential

Water savings potential from public information and outreach depends to a significant degree on the level of investment. Saturation messaging through mass media, especially television and radio, were shown to have the greatest impact on water use during shortages (Syme, et al. 2000). Large-scale campaigns were generally more effective than smaller ones; repetitive messaging was more effective than infrequent messaging. Mercer and Morgan (1980) reached similar conclusions and statistically estimated the relationship between the level of public information expenditure and water savings. Using a time-series sample of water agency expenditure on information campaigns and water use records, they estimated that each one percent increase in public information expenditure decreased water use by 0.04 percent over the range of expenditure and water use evaluated.

This parameter estimate, which Mercer and Morgan referred to as the public information expenditure elasticity, if combined with public information expenditure data, can be used to estimate the amount of water savings potential for given levels of expenditure on public information campaigns aimed at reducing water use. To evaluate whether this approach would provide reasonable water savings estimates, data on public information expenditure per account during the 1987-92 drought were used to estimate the percentage increase

in expenditure required to increase the District's current public information expenditure per account to a level comparable to the average expenditure per account by California water agencies during the 1987-92 drought. The analysis considered the following:

- Over the period 1999-2006, District annual expenditures on public information and outreach, including school education programs, averaged $1.26 per retail water user account (2007 dollars).
- Annual expenditures on public information and outreach by California urban water agencies during the 1987-92 drought were estimated to average $3.40 per account (2007 dollars), or 170 percent more than what the District currently spends on public information and outreach as part of its long-term conservation program.[3]
- The findings by Mercer and Morgan suggest a similar level of spending on public information targeted at shortage management would be expected to reduce demand by approximately 7 percent, which corresponds well with the findings presented in the previous sections on expected water savings from public information campaigns.[4]

7.2.4 Public Information and Outreach Shortage Management Response

The public information expenditure elasticity parameter and data on District expenditure for public information and outreach for long-term conservation were used to estimate additional water savings potential and associated cost for shortage management. Two adjustments were made to the elasticity parameter before using it in the analysis. The first adjustment was to set the maximum water savings from public information and outreach to 10 percent of total water use. This was done for two reasons. First, the elasticity parameter is based on a limited range of expenditure and water conservation response. The validity of the parameter estimate outside this range of response is untested. Second, while case studies of voluntary conservation response have reported water savings from public information and outreach in excess of 10 percent, the statistically derived estimates reviewed for the Strategic Plan indicated that public information and outreach campaigns were most likely to result in water savings in the 5 to 10 percent range. While it is certainly possible that such campaigns can result in water savings in excess of 10 percent, limiting the response to 10 percent was viewed as an appropriately conservative assumption for planning purposes.

The second adjustment was to account for changes in water use efficiency over time that would impact water users' ability to adjust their water use through behavioral responses. To understand the need for this adjustment, consider three households. The first household has a toilet that flushes 3.5 gallons. In the second household, the toilet flushes 1.6 gallons, while in the third household

3 Data and assumptions supporting these estimates are presented in Appendix B.

4 This is determined by multiplying the percentage increase in public information expenditure (170 percent) by the Mercer and Morgan elasticity estimate (0.04), which equals 6.8 percent, which is then rounded to 7 percent.

the toilet flushes 1.1 gallons. If all three households reduce their number of flushes by 25 percent in response to public information and outreach to manage a temporary shortage, each household would save a different amount of water. The household with the least efficient toilet would save the most water by flushing less, while the household with the most efficient toilet would save the least. By the same logic, improvements over time in the efficiency of water using hardware and appliances as a result of investment in long-term conservation would be expected to reduce the savings potential from behavioral responses. To account for this effect, the water end uses listed in Table 21 were adjusted for expected efficiencies in 2010, 2020 and 2030 as a result of long-term conservation. The public information elasticity parameter was then adjusted downward in proportion to the indicated change in water savings potential relative to the baseline estimate shown in Table 21. The resulting parameters used to estimate public information response curves for 2010, 2020, and 2030 are shown in Table 23.

Table 23. Public Information Elasticity Parameters Used to Estimate Public Information Response Curves

Baseline	2010	2020	2030
0.0400	0.0354	0.0328	0.0313

Notes:
Parameter estimates percentage decrease in water use given a one percent increase in public information expenditures.
Baseline parameter estimate from Mercer and Morgan (1980).

Table 24 provides estimated 2010, 2020, and 2030 shortage management response costs and water savings for public information and outreach. Water savings are shown in thousands of acre-feet (TAF) while costs are expressed in millions of dollars per year. Costs in Table 24 would be incremental to annual expenditures for public information related to long-term conservation. Lost water sales revenues for the District and its retail water agencies would be in addition to the public information expenditures shown in Table 24. These lost revenues, or at least the portion used to pay water system fixed costs, would need to be recovered from financial reserves or rate increases in subsequent years in order to preserve the financial integrity of the county's water systems.

Table 24. Public Information and Outreach Shortage Management Response Cost and Water Savings

% Demand Reduction	Shortage Starts in 2010		Shortage Starts in 2020		Shortage Starts in 2030	
	Expenditure (mil. $/yr)	TAF	Expenditure (mil. $/yr)	TAF	Expenditure (mil. $/yr)	TAF
2.0%	0.79	7.1	0.87	7.6	0.99	8.5
4.0%	1.07	14.2	1.20	15.3	1.37	17.0
6.0%	1.36	21.3	1.53	22.9	1.75	25.5
8.0%	1.64	28.4	1.86	30.5	2.14	33.9
10.0%	1.92	35.5	2.19	38.1	2.52	42.4

7.3 Conservation Measures and Programs

In addition to investing more in public information/awareness campaigns, the District also can temporarily expand its long-term regional conservation programs during a water shortage. This has the effect of shifting forward in time a portion of long-term water savings so they are available to help address the temporary water shortage.

The Strategic Plan evaluated the potential water savings over three years from temporarily expanding the conservation measures evaluated for the long-term plan. Because the availability of conservation measures changes over the planning period in response to implementation of measures to achieve the long-term conservation water savings target, the analysis considered potential savings for 2010, 2020, and 2030. Table 25 shows the subset of long-term conservation measures that could be implemented or expanded to respond to a temporary water shortage. Note that this table does not include all the conservation measures evaluated for the long-term plan, but rather just those that could be rapidly expanded in response to a temporary water shortage. It is important to emphasize that the water savings from expanding implementation of these measures would be in addition to the water savings already being generated by the District's long-term conservation programs.

Table 25 shows whether a measure is needed to achieve the long-term targets (column 3), the annual implementation required for achieving the long-term targets (column 4), and the maximum annual implementation (column 5). The last two columns, shaded in gray, show the incremental amount of annual activity available for demand management during a shortage. If a measure is part of the long-term plan, then the incremental amount of annual activity equals the difference between the long-term annual implementation and the maximum annual implementation for 2010 and 2020 (column 5), and zero for 2030 (column 6). Measures included in the long-term plan are zeroed out in 2030 because most of their savings potential will already have been exhausted by long-term program implementation. If a measure is not part of the long-term plan,

then the incremental amount of annual activity for 2010, 2020, and 2030 is equal to the maximum annual implementation level.

The analysis adopted the following cost assumptions for implementing measures for demand management during a shortage:

- The unit cost for measures included in the long-term plan was assumed to increase to reflect the additional costs of marketing, administration, and potentially higher financial incentive costs required to expand participation beyond the annual implementation required for achieving the long-term targets. Unit costs for toilet rebates were assumed to increase by 50% because these measures would already be running at a high level. The unit cost markup for toilet direct install measures was assumed to be less that for toilet rebates (30% versus 50%) since this measure would entail an increase in marketing but not financial incentive costs. A 25% markup was assumed for all other measures.
- The unit cost for measures not included in the long-term plan was assumed to equal what these measures would cost if they were part of the long-term plan. This assumption reflect the fact that the maximum annual implementation levels for these measures are similar to what their implementation levels would have been were they part of the long-term plan.

Table 26 shows the unit cost ($/AF) of each measure, sorted from lowest to highest cost. Next to these unit costs, the table shows the percentage markup over the estimated long-term unit cost. Note these unit costs do not account for District cost sharing or grant funding arrangements that might be in place at the time of implementation. Also shown in the table are the annual water savings that could be generated over a three-year period by each measure. These water savings would persist after the end of the three-year period, providing long-term water savings benefits to the District. Only the water savings accruing over the assumed three-year shortage are shown in the table, however.

Table 25. Conservation Measure Implementation Available for Shortage Management

Conservation Measure (customer class)	Units	Long-term Plan	Long-term Activity	Max Annual Activity	Shortage Activity 2010/2020	Shortage Activity 2030[1]
HET Rebate (SF)	Rebates	Y	8,360	12,000	3,600	0
Clotheswasher Rebate (SF)	Rebates	N		10,000	10,000	10,000
Landscape Rebate (SF)	Sites	N		450	450	450
Lg Landscape Survey & Hardware Rebate (excluding WBICs) (SF,MF)	Sites	Y	40	50	10	0
WBIC Rebates for Large Landscapes (SF)	Sites	Y	175	200	25	0
Small Landscape Survey & Hardware Rebate (including WBICs) (SF)	Sites	N		3,000	3,000	3,000
Irrigation Hardware Rebate for New Construction (SF)	Rebates	N		700	700	700
HET Direct Install (MF)	Toilets	Y	2,587	3,500	1,000	0
Clotheswasher Rebate: In-Unit (MF)	Rebates	N		1,700	1,700	1,700
Clotheswasher Rebate: Common Area (MF)	Rebates	N		175	175	175
Landscape Rebate (MF)	Sites	N		50	50	50
Irrigation Hardware Rebate for New Construction (MF)	Sites	Y	20	30	10	0
HET Direct Install (Hi Use) (CII)	Toilets	Y	598	791	193	0
HET Direct Install (Lo Use) (CII)	Toilets	N		2,210	2,210	2,210
Clotheswasher Rebate (CII)	1,000 lbs/yr	N		12,000	12,000	12,000
Industrial Process (CII)	Sites	Y	5	10	5	0
Medical Sterilizers – Condensate (CII)	Rebates	Y	5	10	5	0
Medical Sterilizers – Ejector (CII)	Rebates	Y	5	10	5	0
Food Steamers (CII)	Rebates	N		30	30	30
Landscape Rebate (CII)	Sites	N		20	20	20
Lg Landscape Survey & Hardware Rebate (excluding WBICs) (CII)	Surveys	Y	80	100	20	0
WBIC Rebates for Large Landscapes (CII)	Rebates	Y	200	250	50	0
Small Landscape Hardware Rebate (excluding WBICs) (CII)	Surveys	N		120	120	120
WBIC Rebates for Small Landscapes (CII)	Rebates	N		75	75	75

Notes:
1. Zero activity in 2030 indicates savings potential has been exhausted by long-term implementation.

Table 26. Unit Cost and Water Savings of Short-Term Conservation Measures

Conservation Measure (customer class)	Short-term Unit Cost ($/AF)[1]	% Markup Over Long-term Unit Cost[2]	3-Year Total Water Savings 2010/2020 (AF)[3]	3-Year Total Water Savings 2030 (AF)[4]
Medical Sterilizers - Condensate (CII)	$168	25%	42	0
WBIC Rebates for Large Landscapes (SF)	$197	25%	106	0
WBIC Rebates for Large Landscapes (CII)	$197	25%	211	0
Irrigation Hardware Rebate for New Construction (MF)	$294	25%	14	0
Lg Landscape Survey & Hardware Rebate (excluding WBICs) (CII)	$325	25%	84	0
Lg Landscape Survey & Hardware Rebate (excluding WBICs) (SF,MF)	$329	25%	42	0
Industrial Process (CII)	$340	25%	531	0
Medical Sterilizers - Ejector (CII)	$376	25%	58	0
HET Direct Install (MF)	$494	30%	309	0
Clotheswasher Rebate (CII)	$508	0%	333	333
Irrigation Hardware Rebate for New Construction (SF)	$564	0%	142	142
HET Direct Install (Hi Use) (CII)	$572	30%	56	0
HET Rebate (SF)	$799	50%	525	0
HET Direct Install (Lo Use) (CII)	$933	0%	300	300
Food Steamers (CII)	$1,003	0%	45	45
Small Landscape Hardware Rebate (excluding WBICs) (CII)	$1,015	0%	43	43
WBIC Rebates for Small Landscapes (CII)	$1,059	0%	36	36
Clothes washer Rebate: Common Area (MF)	$1,083	0%	46	46
Clothes washer Rebate (SF)	$1,220	0%	939	939
Landscape Rebate (CII)	$1,326	0%	11	11
Landscape Rebate (MF)	$1,328	0%	288	288
Landscape Rebate (SF)	$1,710	0%	473	473
Clothes washer Rebate: In-Unit (MF)	$3,045	0%	64	64
Small Landscape Survey & Hardware Rebate (including WBICs) (Surveys)	$4,622	0%	42	42
3-Year Total Water Savings (AF)			4,739	2,762

Notes:
1. Unit costs do not account for District cost sharing or grant funding arrangements that might be in place at the time of implementation.
2. Unit costs for toilet rebates assumed to increase by 50% to cover higher incentive and marketing costs to increase participation rates; direct install toilet costs assumed to increase by 30% for similar reasons. Unit costs for all other measures assumed to increase by 25% if measure already being implemented as part of the long-term plan. Unit costs for measures not part of the long-term plan assumed to equal their long-term unit cost.
3. Cumulative water savings over three-year period in acre-feet.
4. Zero measure savings in 2030 indicates the measures savings potential has been captured by the long-term program.

The information in Tables 25 and 26 was used to generate shortage management conservation measure supply curves. These curves, shown in Figure 7, show the total amount of water savings attainable over three years at different levels of District expenditure. The lower curve shows the saving potential for shortages in 2010 and 2020 while the upper curve shows the potential for 2030. For example, District expenditures of $3.33 million per year ($10 million over 3 years) would save approximately 3,100 AF over three years during shortages in 2010 or 2020. However, the same level of expenditure in 2030 would only yield approximately 1,900 AF. Savings potential in 2030 is much lower than in 2010 and 2020 because long-term conservation activity has absorbed most of the potential of the lower cost measures by 2030.

Tables 27 and 28 show cumulative District expenditures and water savings for 2010/2020 and 2030 assuming investment in measures costing up to $500, $1,000, $1,500, and $2,000 per acre-foot. Table 27, for example, shows that investing in 2010 or 2020 in short-term measures with unit costs of up to $1,000/AF would involve a three-year cumulative expenditure of about $8.5 million and would yield 1,370 AFY by the third year of the shortage.

Table 28 shows significantly less savings potential in 2030 than in 2010 or 2020. There is no savings potential from measures costing up to $500/AF and only limited potential for measures costing up to $1,000/AF. Most of the remaining potential involves measures costing more than $1,000/AF. This is due to the fact that activity under the long-term plan has absorbed most of the savings potential of lower cost measures by 2030.

Figure 7. Conservation Measure Water Shortage Supply Curves: 2010/2020 and 2030

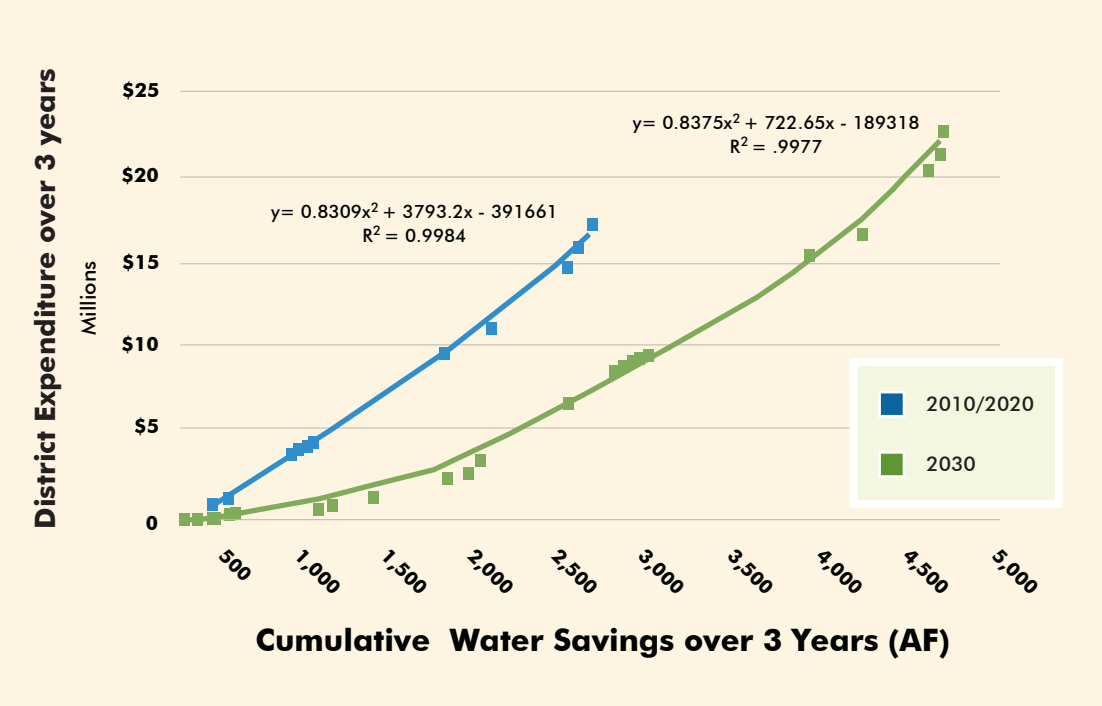


Table 27. District Outlays and Savings Potential of Short-term Measures: 2010/2020

Unit Cost of Conservation Measures	Shortage Year	Water Savings (AF/Yr)[1]	District Annual Expense (Mil. $)	District Cumulative Expense (Mil. $)
Up to $500/AF	Year 1	230	$0.69	$0.69
	Year 2	470	$0.69	$1.39
	Year 3	700	$0.69	$2.08
Up to $1000/AF	Year 1	460	$2.85	$2.85
	Year 2	920	$2.85	$5.69
	Year 3	1,370	$2.85	$8.54
Up to $1500/AF	Year 1	700	$5.66	$5.66
	Year 2	1,390	$5.66	$11.32
	Year 3	2,070	$5.66	$16.98
Up to $2,000/AF	Year 1	780	$6.85	$6.85
	Year 2	1,550	$6.85	$13.69
	Year 3	2,310	$6.85	$20.54

Notes:
1. Water savings from measures would persist beyond three years, providing water conservation benefits for many years after the end of the water shortage.

Table 28. District Outlays and Savings Potential of Short-term Measures: 2030

Unit Cost of Conservation Measures	Shortage Year	Water Savings (AF/Yr)[1]	District Annual Expense (Mil. $)	District Cumulative Expense (Mil. $)
Up to $500/AF	Year 1	-	$-	$-
	Year 2	-	$-	$-
	Year 3	-	$-	$-
Up to $1000/AF	Year 1	130	$1.03	$1.03
	Year 2	260	$1.03	$2.07
	Year 3	390	$1.03	$3.10
Up to $1500/AF	Year 1	370	$3.85	$3.85
	Year 2	730	$3.85	$7.69
	Year 3	1,090	$3.85	$11.54
Up to $2,000/AF	Year 1	440	$5.03	$5.03
	Year 2	890	$5.03	$10.06
	Year 3	1,330	$5.03	$15.10

Notes:
1. Water savings from measures would persist beyond three years, providing water conservation benefits for many years after the end of the water shortage.

7.4 Mandatory Restrictions and Pricing

As the region's wholesale water supplier, the District does not have the authority to adopt ordinances or impose mandatory provisions restricting the wasteful use of water nor does the District have authority to set or enforce consumption limits at the retail level. As a result, this Strategic Plan does not include per capita allotments, inclining-block rates, penalties, or incentives for demand reduction for any customer class. The development of such mechanisms is within the purview of cities, the County and the local retail water agencies. Instead, in the event of severe water shortage, the District will work with local retail water suppliers to establish water use reduction targets. By working closely with its retail water agencies, the District has effectively set and achieved up to 25 percent mandatory water use reduction levels in the past. This level of water savings from mandatory water use restrictions and pricing is consistent with savings from mandatory measures estimated by Hanemann and Nauges (2005), Renwick and Green (2000), and RAND (1996).

7.5 Summary of Shortage Response Water Savings and Costs

The demand management responses described in this section would be incremental to the implementation of long-term conservation measures described in Section 6. Three types of demand management response were evaluated:

- Public Information and Outreach
- Conservation Measures and Programs; and
- Mandatory Restrictions and Price-Induced Conservation

Public information and outreach campaigns were found to be the most effective immediate demand management response to temporary water shortages in terms of both water savings potential and cost-effectiveness. Public information and outreach emphasizes changes in behavior to reduce water use. Effective messaging coupled with outreach programs (such as the Housecalls survey program) can generate significant short-term reductions in demand at relatively low cost to the District. Because the demand reductions are driven primarily by changes in behavior, most of which may involve added inconvenience and cost to water users, demand is likely to rebound following the shortage. Most of the water savings will not be permanent.

While accelerating water savings from long-term conservation measures to produce short-term water savings for shortage management is feasible, the water savings potential is not very great and the cost is high. These measures are primarily designed to improve the efficiency of water using fixtures, appliances, processes, and landscapes over a long period. Unlike behavioral responses, water savings from these measures are persistent and accrete to produce significant efficiency gains over the long run. However, a rapid expansion of these programs in response to a temporary shortage would require considerable District expenditure and would generate a limited amount of short-term water savings. For this reason, investment in these measures for shortage management should be given lower priority than investment in public information and outreach.

The District is currently reviewing its authority to adopt ordinances, impose mandatory provisions restricting the wasteful use of water, or set or enforce consumption limits at the retail level. Because of uncertainty regarding the District's ability to pursue these types of measures, the Strategic Plan did not consider per capita allotments, inclining-block rates, penalties, or incentives for demand reduction for any customer class. Clarification of the District's authority and jurisdiction with respect to water use ordinances and restrictions will allow future updates of the Strategic Plan to consider incorporation of these strategies.

Tables 29 and 30 summarize the costs to the District of achieving increasing amounts of demand management water savings over a 3-year water shortage through a combination of public information and outreach and acceleration of long-term conservation measures.

Lost water sales revenues for the District and its retail water agencies would be in addition to the public information and conservation measure expenditures shown in these two tables. Any lost revenues would need to be recovered from financial reserves or rate increases in subsequent years in order to preserve the financial integrity of the county's water systems.

Table 29. Public Information/Outreach Shortage Response Water Savings and Costs

Cumulative Water Savings Over 3 Years	3-Yr Cost to Achieve Cumulative Savings		
	Shortage Starts in 2010	Shortage Starts in 2020	Shortage Starts in 2030
(TAF)	(Mil $)	(Mil $)	(Mil $)
15	2.1	2.3	2.5
30	2.7	2.9	3.2
45	3.3	3.6	3.8
60	3.9	4.2	4.5
75	4.5	4.9	5.2
90	5.1	5.5	5.9
105	5.7	6.2	6.6
120	*	6.8	7.2
135	*	*	7.9

* Cumulative savings from public information/outreach capped at 10 percent of projected demand.

Table 30. Accelerated Long-Term Conservation Shortage Response Water Savings and Costs

Cumulative Water Savings Over 3 Years	3-Yr Cost to Achieve Cumulative Savings		
	Shortage Starts in 2010	Shortage Starts in 2020	Shortage Starts in 2030
(TAF)	(Mil $)	(Mil $)	(Mil $)
0.5	0.4	0.4	1.5
1.0	1.4	1.4	3.7
1.5	2.8	2.8	6.4
2.0	4.6	4.6	9.5
2.5	6.9	6.9	13.0
3.0	9.5	9.5	17.0
3.5	12.6	12.6	21.3
4.0	16.1	16.1	26.1
4.5	20.0	20.0	31.3
5.0	24.4	24.4	36.8

8 Monitoring and Evaluation

8.1 Section Introduction

In order to make informed decisions regarding immediate and long-term water supply challenges, it is imperative that water conservation staff continue to monitor and evaluate water conservation program activity and water supply outlook.

8.2 Monitoring

As a wholesale supplier of water to Santa Clara County, end use water consumption of Santa Clara County's residential, CII, and agriculture sectors is difficult to track. Since the District implements water conservation programs and supplies water for the entire county, District water savings and demand requirements will be documented through water conservation program activity levels, updating of passive savings tables, and coordinating with the District's water supply management units.

8.2.1 Long-Term Conservation Plan Monitoring

To verify that water conservation efforts meet the 2003 IWRP and 2005 UWMP 2030 goals of 98,500 acre-feet per year of water savings, water conservation staff will collect and document program activity levels for residential, commercial, industrial, institutional and agriculture sectors and update the Strategic Plan Active Water Savings Tables quarterly.

In addition to monitoring active savings resulting from program activity levels, it is also necessary to continue to document passive savings in order to fully assess total water savings in Santa Clara County. District staff will collect and document annual passive water savings garnered by natural replacement, legislation, and municipal or county ordinances and update the Strategic Plan Passive Water Savings Tables.

8.2.2 Shortage Management Response Monitoring

To properly monitor water supply in order to gauge an accurate shortage management response, water conservation staff will coordinate with the district's water supply management units regarding water deliveries and water supply outlook. Staff will remain current on projected water supply and deliveries from import (CVP and SWP), surface, and groundwater supplies and evaluate the data with estimations made in this report on an annual and 5-year cycle.

8.3 Evaluation

In order to ensure program goals are met, water conservation staff will evaluate Strategic Plan Water Savings Tables annually. These tables along with annual water supply data will allow staff to make mid stream changes in program implementation, update budget/savings forecasts and to prepare the correct level of water shortage management response.

9 Program Plan Updating

9.1 Conservation Plan Updates

To ensure that the District cost effectively meets the 2003 IWRP identified conservation water savings goal of 98,500 acre-feet by 2030, it is necessary for water conservation staff to review and update the least-cost plan for achieving long term targets, level of program implementation, program schedule, estimated costs of proposed programs and compliance with the Memorandum of Understanding Regarding Urban Water Conservation in California.

9.1.1 Least-cost Plan for Achieving Long Term Targets

Water conservation staff will update the least cost program implementation plan on a five year cycle. This update will include the introduction of new water saving technologies and their associated costs and savings. The update will also include program activity data that may verify or alter assumptions made regarding selected least-cost plan programs water savings or costs.

9.1.2 Program Implementation Levels

Data from the Strategic Plan Water Savings Tables will be used to update forecasted savings projections on a quarterly and annual basis, as well as provide water conservation staff with the necessary information to update the strategic plan on a five year cycle.

In addition to program activity level data, updates to the plan will include analysis of passive water savings using the Strategic Plan Passive Water Savings Tables and updates to passive savings assumptions including any new studies, codes, ordinances or laws that may impact projected passive water savings detailed or anticipated in this report.

9.1.3 Program Schedule

Updates to the program schedule will be based on program implementation level analysis. Water conservation staff will compare projected program activity with actual program activity levels and make necessary updates to the program schedule to achieve the IWRP and UWMP 2030 water savings goals. Program activity data will be collected on a quarterly and annual basis and updates to the strategic report will be made on a five year cycle.

9.1.4 Estimated Costs of Proposed Programs

Based on program activity and industry consultation, District staff will verify that program costs and cost escalation are in line with estimations made in this report. Updates will be provided on five-year cycle.

9.1.5 MOU Compliance

Water conservation staff will continue to work with the California Water Urban Water Conservation Council to remain in compliance with the council's Memorandum of Understanding regarding urban water conservation. When cost effective, program activity levels will be modified to ensure compliance and maximize water savings.

As a plan update measurement, adoption of new best management practices (BMPs) or modifications of existing BMPs will be documented in this plan on a five-year cycle.

References

AWWA Research Foundation. 1999. "Residential End Uses of Water." Denver, CO.

AWWA Research Foundation. 2000. "Commercial and Institutional End Uses of Water." Denver, CO.

California Department of Water Resources. 2007. "The State Water Project Delivery Reliability Report 2007: Draft," December 2007.

California Urban Water Conservation Council. 2005. "BMP Costs & Savings Study: A Guide to Data and Methods for Cost-Effectiveness Analysis of Urban Water Conservation Best Management Practices, Draft Revision."

Hanemann, W. M. and Celine Nauges. 2005. "Heterogeneous Responses to Water Conservation Programs: The Case of Residential Users in Los Angeles." CUDARE Working Papers No. 1026. University of California, Berkeley.

Mercer, L.J.,and W.D. Morgan.1980. "Impact of a water conservation campaign: Some extensions on a time series analysis." Evaluation Review4:107-17.

M.Cubed. 2004. "Santa Clara County Residential Water Use Baseline Survey: Final Report." Prepared for Santa Clara Valley Water District. August 2004.

RAND. 1996. "Drought Management Policies and Economic Effects in Urban Areas of California, 1987-1992." Santa Monica, CA.

Renwick, M.E. and S. O. Archibald. 1998. "Demand Side Management Policies for Residential Water Use: Who Bears the Conservation Burden?" Land Economics, 74(3):343-359.

Renwick, M.E and R. D. Green. 2000. "Do Residential Water Demand Side Management Policies Measure Up? An Analysis of Eight California Water Agencies." Journal of Environmental Economics and Management, 40:37-55.

Santa Clara Valley Water District. 2006. "Water Use Efficiency Program Annual Report, Fiscal Year 2005-2006."

Santa Clara Valley Water District. 2006. "Water Utility Enterprise Report: Final."

Santa Clara Valley Water District. 2005. "Urban Water Management Plan 2005."

Santa Clara Valley Water District. 2003. "Integrated Water Resources Planning Study 2003."

Santa Clara Valley Water District. 2000. "Draft Drought Management Plan."

Syme, Geoffrey J., Blair E. Nancarrow, and Clive Seligman. 2000. "The Evaluation of Information Campaigns to Promote Voluntary Household Water Conservation." Evaluation Review, 24 (6):539-578.

Appendix A

Conservation Program Qualitative Screen Results

Qualitative Screen of Potential Program Changes								
				QUALITATIVE SCREENING CRITERIA AND RATINGS				
				1 (Worst) => 5 (Best)				
Category	Technology	Current Programs	Potential Program Changes	Implementation Feasibility (A-1)	Savings Quantification (A-2)	Acceptance (A-3)	Relation to Other Programs (A-5)	Savings, Costs (A-6)
SF Interior Existing Construction	Clothes Washers	Rebates	Add salesperson incentives	1	2	3	4	3
			Limited-term higher rebates	5	3	5	4	5
			ROR ordinance	1	3	2	4	5
	Toilets	HET Rebates	Limited-term higher rebates	5	3	5	4	5
			Potential joint direct install program with PG&E.	2	2	3	3	4
			Direct Distribution Program (schools, special events, etc.)	2	4	4	2	3
			ROR ordinance	1	3	2	4	5
	Showerheads	Distribution	ROR ordinance	1	3	2	4	5
	Aerators	Distribution	ROR ordinance	1	3	2	4	5
SF Exterior Existing Construction	Landscape Design	Rebates	Broader set of efficient design rebates (not just cash-for-grass)	3	2	4	4	3
			Enhanced enforcement of Model Efficient Landscape Ordinance.	1	2	3	4	2
			ROR ordinance	1	3	2	4	5
	Irrigation hardware	ITAP surveys Irrig. Hardware rebates WBIC rebates	Integrate two rebates	3	3	4	3	4
			ROR ordinance	1	3	2	4	5
MF Interior Existing Construction	Clothes Washers	Rebates	Add salesperson incentives	1	2	2	4	3
			Limited-term higher rebates	5	3	5	4	5
			ROR ordinance	1	3	2	4	5
	Water softeners	Rebate	Operating restrictions, replacement incentives	1	3	2	3	3
	Toilets	HET Rebates HET Install	Direct Distribution Program (schools, special events, etc.)	2	4	3	2	3
			Limited-term higher rebates	5	3	5	4	5
			ROR ordinance	1	3	2	4	5
	Showerheads	Distribution	ROR ordinance	1	3	2	4	5
	Aerators	Distribution	ROR ordinance	1	3	2	4	5
MF Exterior Existing Construction	Landscape Design	Rebates	Broader set of efficient design rebates (not just cash-for-grass)	3	2	4	4	3
			Enhanced enforcement of Model Efficient Landscape Ordinance.	1	2	3	4	2
			ROR ordinance	1	3	2	4	5
	Irrigation hardware	ITAP surveys Irrig. Hardware rebates WBIC rebates	Integrate two rebates	3	3	4	3	4
			ROR ordinance	1	3	2	4	5
CII Interior Existing Construction	Toilets	HET Install	Target high-use industries	4	5	4	4	5
			ROR ordinance	1	3	2	4	5
	Urinals	Valve Retrofit	Direct installs	5	4	5	4	4
			ROR ordinance	1	3	2	4	5
	Cooling towers	Rebates	Technical support & site inspections. Mandatory standards	2	3	2	3	2
	Clotheswashers	Rebates	Re-examine rebate structure	4	2	3	3	3
			Piggyback onto existing energy utility program(s).	2	3	4	4	3
			Focus on industrial laundries	2	3	2	3	4
	Process	WET Rebates	Increase rebates	4	4	5	4	4
			Tie to CII surveys	2	2	2	3	3
			Enhanced marketing	5	4	5	5	5
	Various	Surveys	Target industries with high savings potential.	3	3	3	4	3
			Tie to WET	2	2	2	3	3
CII Exterior Existing Construction	Irrigation hardware	ITAP surveys Irrig. Hardware rebates WBIC rebates	Integrate two rebates	3	3	4	3	4
			Make available to smaller acreage (< 1 acre) w/o ITAP requirement	4	3	5	4	4
			ROR ordinance	1	3	2	4	5
	LAMS	Water budgets	Link water budgets to financial incentives	3	3	4	5	4

Qualitative Screen of Potential New Programs: Step 1

				QUALITATIVE SCREENING CRITERIA					
				1 (Worst) => 5 (Best)					
Category	Technology		Delivery Mechanism	Implementation Feasibility (A-1)	Savings Quantification (A-2)	Acceptance (A-3)	Utility Match (A-4)	Relation to Other Programs (A-5)	Savings, Costs (A-6)
SF Interior Existing Construction	Hot water recirculation		Rebate	1	2	3	3	3	2
SF Interior New Construction	Hot water recirculation		Rebate	3	1	3	2	4	3
	Clotheswashers		Rebate	4	4	4	2	4	3
	HET		Rebate	4	4	5	4	4	3
SF Exterior Existing Construction	Pool covers		Promotion	2	2	3	3	4	2
			Rebate	2	2	3	3	4	2
	Grey water		Rebate	2	2	1	2	4	3
SF Exterior New Construction	Irrigation		Rebate	3	2	4	4	4	4
	Design		Rebate						
			Ordinance	3	2	3	4	4	4
	Grey water		Rebate	2	2	1	2	4	3
MF Interior Existing Construction	Hot water recirculation		Rebate	1	2	3	3	3	2
	Submetering		Rebate	2	3	3	3	4	3
MF Interior New Construction	Water softeners		Rebate						
	Hot water recirculation		Rebate	3	1	3	2	4	3
	Clotheswashers		Rebate	3	3	3	3	4	3
	Submetering		Rebate	2	3	3	3	4	3
	HET		Rebate	4	4	5	4	4	3
MF Exterior Existing Construction	Pool covers		Promotion	2	2	3	3	4	2
			Rebate	2	2	3	3	4	2
	Grey water		Rebate	2	2	1	2	4	3
MF Exterior New Construction	Irrigation		Rebate	3	2	4	4	4	4
			Ordinance	3	2	3	4	4	4
	Design		Rebate						
			Ordinance	3	2	3	4	4	4
	Grey water		Rebate	2	2	1	2	4	3

Qualitative Screen of Potential New Programs: Step 1

				QUALITATIVE SCREENING CRITERIA					
				1 (Worst) => 5 (Best)					
Category	Technology		Delivery Mechanism	Implementation Feasibility (A-1)	Savings Quantification (A-2)	Acceptance (A-3)	Utility Match (A-4)	Relation to Other Programs (A-5)	Savings, Costs (A-6)
CII Interior Existing Construction	Hot water recirculation		Rebate	2	2	3	3	3	1
	Car wash recirculation		Standards	1	2	2	2	3	2
			Rebates	3	2	3	2	3	2
	Water Softeners		Standards	3	2	3	3	4	2
	Dishwashers		Rebates	4	2	3	3	3	2
	Medical sterilizers		Rebates	4	3	3	3	3	3
	Food steamers		Rebates	4	3	3	3	3	3
	Cooling, refrigeration, ice makers		Rebates	2	3	3	3	3	3
CII Interior New Construction	Water softeners		Rebate						
	Hot water recirculation		Rebate	3	3	3	3	3	3
	Clotheswashers		Rebate	3	3	3	3	4	3
	HET		Rebate	3	4	5	4	4	4
	Dishwashers		Rebate	3	2	3	3	4	2
	Medical sterilizers		Rebate	3	3	3	3	4	3
	Food steamers		Rebate	3	3	3	3	4	3
	Faucets (IR, spring-loaded)		Rebate	2	2	3	3	2	1
CII Exterior Existing Construction	Landscape design		Rebate						
	Pool covers		Promotion	2	2	3	3	4	2
			Rebate	2	2	3	3	4	2
	Grey water		Rebate	2	2	1	2	4	3
CII Exterior New Construction	Irrigation		Rebate	3	2	4	4	4	4
			Ordinance	3	2	3	4	4	4
	Design		Rebate						
			Ordinance	3	2	3	4	4	4
	Grey water		Rebate	2	2	1	2	4	3
	Metering		Financial incentive to install dedicated irrigation meters..	1	3	2	3	3	1
			Ordinance to require installation of dedicated irrigation meters..	3	3	3	4	4	4
Miscellaneous	Distribution System		Retailer incentives for leak detection & repair	3	3	4	4	4	4
	Rates		Advice & tech assistance to retailers	2	2	2	3	4	3

Appendix B

Detailed Program Analysis Savings and Cost Parameter Values

Program Savings and Cost Assumptions Single Family							
Program	Per-Participant Savings	Savings Life	Natural Replacement	Free Ridership	Per-Participant Cost		Annual Fixed Cost
	(gpd) *	(Years)	(%)	(%)	Admin	Rebate	
	*(Unless indicated otherwise)						
HET Rebate	29.70	25	4.0%	25.0%	$40	$125	$39,646
Clothes Washer Rebate (Existing & New Const)	17.50	12	0.36%	20.0%	$40	$150	$28,080
Landscape Rebates (units are sq ft)	0.085	10	n/a	n/a	$0.40	$1.00	$20,513
Lg Lndscp Survey & Hardware Rebates					$1,000		$2,150
Survey	555	10	n/a	n/a			
Equipment Rebates	555	10	n/a	n/a		$4,000	
WBIC Rebates for Large Landscapes	629	10	n/a	n/a	$229	$700	$8,286
Small Lndscp Hardware Rebates					$75		$2,150
Survey	30.00	10	n/a	n/a			
ET Controller Rebates	37.00	10	n/a	n/a		$350	
Other Rebates	30.00	10	n/a	n/a		$250	
Irrigation Hdwr Rebate for New Construction					$45		$2,150
ET Controller	37.00	10	n/a	n/a		$100	
Other Rebates	30.32	10	n/a	25.0%		$100	

Program Savings and Cost Assumptions Multi-Family							
Program	Per-Participant Savings	Savings Life	Natural Replacement	Free Ridership	Per-Participant Cost		Annual Fixed Cost
	(gpd) * *(Unless indicated otherwise)	(Years)	(%)	(%)	Admin	Rebate	
HET Install	52.44	25	4.0%	10.0%	$255	$0	$2,854
Clothes Washer Rebate In-Unit (Existing & New Const)	7.00	12	0.4%	20.0%	$40	$150	$7,020
Clothes Washer Rebate Common (Existing & New Const)	49.41	12	0.4%	20.0%	$40	$400	$7,020
Landscape Rebates (Units are sq ft)	0.085	10	n/a	n/a	$0.07	$1.00	$13,675
Irrigation Hdwr Rebate for New Conltruction					$89		$0
ET Controller	260.05	10	n/a	n/a		$250	
Other Rebates	213.07	10	n/a	25.0%		$250	
Submetering Rebate: Existing Construction	21.80	25	n/a	n/a	$25	$150	
Submetering Rebate: Mobile Homes	50.00	25	n/a	n/a	$25	$100	
Submetering Rebate: New Construction	21.80	25	n/a	n/a	$25	$100	

Program Savings and Cost Assumptions CII HET Direct Installations							
Sector	Per-Participant Savings	Savings Life	Natural Replacement	Free Ridership	Per-Participant Cost		Annual Fixed Cost
	(gpd) * *(Unless indicated otherwise)	(Years)	(%)	(%)	Admin	Rebate	
Hotels	20.00	25	4.0%	20.0%	$265	$0	$2,000
Offices	25.00	25	4.0%	20.0%	$265	$0	$2,000
Schools	67.50	25	4.0%	20.0%	$265	$0	$2,000
Restaurants	58.75	25	4.0%	20.0%	$265	$0	$2,000
Health Facilities	26.25	25	4.0%	20.0%	$265	$0	$2,000
Retail-Wholesale	52.50	25	4.0%	20.0%	$265	$0	$2,000
Industrial	28.75	25	4.0%	20.0%	$265	$0	$2,000
Other	27.08	25	4.0%	20.0%	$265	$0	$2,000

Program Savings and Cost Assumptions CII Other								
Program	Per-Participant Savings	Savings Life	Natural Replacement	Free Ridership	Per-Participant Cost		Annual Fixed Cost	Annual Per-Participant Cost
	(gpd) *	(Years)	(%)	(%)	Admin	Rebate		
	*(Unless indicated otherwise)							
Clothes Washer Rebate Long-Term (Existing & New Const)	1,508	14	n/a	n/a	$1.48	$22	$35,100	
Industrial Process Rebates	40%	5	n/a	n/a	$10,000	$1,000		
Medical Sterilizers: Condensate Type	1,242	20	n/a	n/a	$100	$1,250	$7,500	
Medical Sterilizers: Ejector Type	1729	20	n/a	n/a	$7,450	$7,350	$7,500	
Food Steamers	223	15	n/a	n/a	$100	$2,500	$10,000	
Lg Lndscp Survey & Hdwr Rebate					$1,000		$2,150	
Survey	555	10	n/a	n/a		$0		
Equipment Rebates	555	10	n/a	n/a		$4,000		
Small Lndscp Hardware Rebates					$400		$2,150	
Survey	47	10	n/a	n/a		$0		
Equipment Rebates	64	10	n/a	n/a	$400	$1,000		
Lg Lndscp Budget (Dedicated Meters)	1,394	25	n/a	n/a	$142	n/a	$3,000	
Lg Lndscp Budget (Mixed Meters)	548	25	n/a	n/a	$142	n/a	$3,000	$100
Landscape Rebates (units are sq ft)	0.085	10	n/a	n/a	$0.074	$1.00	$3,846	
WBIC Rebates for Large Sites	629	10	n/a	n/a	$240	$700	$8,286	
WBIC Rebates for Small Sites	72	10	n/a	n/a	$333	$350	$4,143	
CII Surveys (Cost only)							$125,000	

Program Savings and Cost Assumptions Miscellaneous Programs						
Program	Per-Participant Savings	Savings Life	Natural Replacement	Free Ridership	Per-Participant Cost	
	(gpd) *	(Years)	(%)	(%)	Admin	Rebate
	*(Unless indicated otherwise)					
Retailer Incentives for Leak Detection & Repair	1% of county-wide demand by 2020	25	5.0%	25.0%		$2,000

Appendix C

Review of Literature on Voluntary Conservation Programs and Information Campaigns

Summary of Findings

The literature on effectiveness of voluntary, mandatory, and price-based urban water conservation policy instruments was reviewed to determine reasonable ranges of water savings to expect from the implementation of conservation campaigns in response to drought-induced water shortages.

Finding 1: Public Information Programs and Voluntary Conservation Measures

Reviewed literature suggests that public information campaigns, appeals for conservation, and voluntary measures are mildly to moderately effective at reducing water use. Estimates of effectiveness typically range from 0% to 30% of average household water use. Syme, et al. (2000) concluded that education campaigns could result in significant (up to 25%) water savings in short-term or crisis situations, but that the effectiveness of such campaigns in the longer term has yet to be demonstrated. Estimates of the effectiveness of voluntary conservation measures during the 1987-92 California drought by Hanemann and Nauges (2005) and by Renwick and Green (2000) cluster around 10% of average household demand.

For strategic planning, we recommend the following savings range for short-term response to public information programs and voluntary conservation measures:

Lower-bound – 5% of average household demand

Best Estimate – 10% of average household demand

Upper-bound – 15% of average household demand

Finding 2: Mandatory or Price-Based Measures

Reviewed literature suggests that mandatory usage restrictions and programs backed by financial or rate-based penalties are moderately to very effective at reducing water use. Estimates of effectiveness range between 15% and 30%, with a central tendency between 25% and 30%. During California's last major drought (1987-1992), mandatory conservation measures were estimated to reduce average household demand by 20% to 30%. During the 1977 drought, Bruvold (1979) estimated that rigorously enforced conservation restrictions implemented by eight Bay Area water agencies reduced per capita household water use by 30% to 60%.

For strategic planning, we recommend the following savings range for short-term response to mandatory conservation and water use restrictions backed by financial or rate-based penalties:

Lower-bound – 15% of average household demand

Best Estimate – 25% of average household demand

Upper-bound – 30% of average household demand

Reviewed Literature

Syme et al. (2000)

Syme, et al. (2000) reviewed the literature addressing effectiveness of publicity and information campaigns to conserve water. They consider both narrative and statistical evaluation studies. They describe the narrative evaluation approach as one that employs information from case studies to assess the outcomes and effectiveness of an information campaign. This contrasts with statistical approaches, which attempt to use regression models and other statistical techniques to control for extraneous factors impacting water use in the presence of information campaigns. They summarized findings from several narrative evaluations, as follows:

Century Research Corporation (1972): Evaluated effectiveness of winter conservation campaigns throughout 17 communities in the United States during droughts. Towns and cities reviewed ranged from small communities to large cities (e.g. Miami). Study concluded that information campaigns should produce an overall reduction of between 15% and 30% if started early in the developing drought situation.

Blackburn (1978): This study estimated that publicity resulted in approximately 20% savings during the 1976 drought in Britain.

Gilbert (1978): This study estimated that information campaigns reduced water use by 15% to 20% during droughts in the mid- to late 1970s over much of the United States.

Berk et al. (1993): This study reported that voluntary campaigns produced water savings as high as 28% in the late 1980s in California.

Syme et al. (2000) also reviewed several statistical studies examining the outcomes of information campaigns and other measures on water use. The authors noted numerous statistical problems associated with these studies, most notably multicollinearity of dependent variables. Based on their review, the authors concluded that "regression-based time-series analyses seem too blunt an instrument to define the effectiveness of information campaigns. For short-term, drought-motivated campaigns, multicollinearity with other variables seems to be an ongoing problem. For longer term campaigns, adequate precision in terms of what should represent publicity and how much differing aspects of the information should be disaggregated still remain problems to be resolved."

With regard to the overall effectiveness of information and public awareness campaigns, Syme, et al. (2000) concluded:

> *it seems from our summative evaluations that education campaigns can result in significant (up to 25%) water savings in short-term or crisis situations. The effectiveness of such campaigns in the longer term has yet to be demonstrated. The appropriate content, format, and mix of media have yet to be established, although written material on its own is unlikely to be effective. It seems that creating an appropriate motivation is important, and there is a need to understand how people's attitudes and behaviors are modified by information campaigns.*

Bruvold (1979)

Bruvold (1979) incorporated household-level attitudinal and behavioral variables into a cross-sectional model of nine Bay Area water districts. The Bruvold study classified conservation campaigns as "mild," "moderate," and "rigorous." Districts with mild campaigns sought savings of 0% to 25% with few or no regulations or penalties. Moderate and rigorous programs adopted a variety and varying levels of penalties and regulations. Program effectiveness was measured as the percentage change in summer per capita use between 1976 and 1977. For the households involved in the study, the estimate of change for mild, moderate, and rigorous programs was 33%, 53%, and 63%, respectively. Water district estimates of the effectiveness of mild programs were lower, about 14%.

Hanemann and Nauges (2005)

Hanemann and Nauges (2005) examined household responses to voluntary, mandatory, and price-induced water conservation programs in Los Angeles during the 1988-1992 drought. According to the authors, study results suggest that the voluntary conservation program induced a reduction in water use that varied between 1% and 13%, depending on household characteristics and temperature zone. The mandatory conservation program induced a reduction in water use that varied between 21% and 29%. Price responsiveness was estimated between -0.29 and -0.47 during the summer season and between 0.0 and -0.19 during the winter season. Responsiveness to voluntary and mandatory programs was also found to vary by season. Small lot customers were more responsive to voluntary programs than large lot customers. This was generally true for mandatory programs as well, but to a much lesser degree. Small lot customers were also found to be more price responsive than large lot customers during the winter season, but not so much during the summer season.

Renwick and Green (2000)

Renwick and Green (2000) assessed the effectiveness of price and demand side management (DSM) policies for reducing urban residential demand for water. The analysis relied on cross-sectional monthly time-series data for eight water agencies in California representing 24% of the state's population. Results suggest that both price and alternative DSM policies were effective in reducing demand, though the magnitude of reduction varied among policies.

In addition to price, the study evaluated six non-price DSM policy instruments. These were: (1) public information campaigns, (2) financial incentives to adopt water efficient technologies, (3) distribution of free plumbing retrofit kits, (4) water rationing/allocation policies, (5) restrictions on certain water uses, and (6) an affidavit compliance policy. With one exception, each of the policies was implemented by at least two of the eight water districts in the study. Only San Francisco implemented the affidavit compliance policy.

Public information campaigns were found to have reduced average residential water demands by 8%. Rebates and financial incentives were found to have a similar impact, reducing average residential water demands by 9%. Rationing and restricting DSM policies were found to be significantly more effective, reducing average residential water demands by 19% and 29%, respectively. The effect on average household water use of the affidavit compliance policy was not found to be significantly different from zero.

Renwick and Archibald (1998)

Renwick and Archibald (1998) assessed the effectiveness of price and DSM policies for reducing residential demand for water in Santa Barbara and Goleta, California. Two DSM policy instruments were evaluated: (1) mandatory reduction in use, enforced with penalty rates (Goleta), and (2) banning use landscape irrigation systems other than hand watering and drip (Santa Barbara). Goleta's allocation policy was estimated to reduce average household water use by 28% while Santa Barbara's irrigation system restrictions were estimated to reduce water use by 16%.

Santa Clara Valley Water District SM