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EXHIBIT CT-50

Introduction

In response to the State Water Resources Control Board (SWRCB) draft Environmental Impact Report (DEIR) released in August 2003 addressing modifications to the U.S. Bureau of Reclamation's Water Right Permits 11308 and 11310, the Pacific Institute was asked to assess the potential for improving water-use efficiency among the five major water districts (the Cachuma contractors) that play a role in the region: Carpinteria Valley Water District (CVWD), Goleta Water District (GWD), Montecito Water District (MWD), City of Santa Barbara (SB), and Santa Ynez River Water Conservation District, Improvement District #1 (SYRWCDID#1). The following analysis concludes that the contractors can reduce their take of water from the Santa Ynez River without a loss of service or quality of life. Substantial water can be freed up for environmental purposes and future expected growth simply by applying existing efficiency technologies and well-understood policies to conserve water, in a cost-effective manner. This potential has been ignored or underestimated by previous studies, including the DEIR, and should play a critical role in meeting future needs. The first section looks at the role of conservation through examination of end uses in individual water agencies. The second part questions some of the methodology and assumptions used in the EIR to project future supply and demand balances.

The recently released DEIR indicates that the proposed releases to protect steelhead and other public trust resources may cause a significant impact to the agencies' water supplies during critical drought years unless drought contingency water conservation measures are implemented. The DEIR states that the water-supply impact during critical drought years "might be mitigable to less than significant levels if the member units were to develop and implement a drought contingency plan to cover the [temporary] water supply shortage." However, the DEIR stops short of analyzing specific measures and alternatives that can mitigate this water-supply impact. Furthermore, it fails to describe how much water can be generated through conservation and/or alternatives or to assess whether the impact can be fully or only partially offset. This report is intended to provide the SWRCB with additional information and details regarding the feasibility of mitigating the water-supply impacts associated with the alternatives in the DEIR as well as other alternatives that may be proposed by the public, including California Trout.

More detailed analysis is necessary to determine the mix of conservation options most appropriate for the individual water agencies and the associated savings, but our initial work suggests that a wide range of alternatives are available that can reduce or eliminate the reasonable expected impacts.

These alternatives include increased water conservation, recycling and reuse, and developing new sources or enhancing use of existing sources of supply, such as increased extraction of water from existing sources, desalination, or the development of access to new sources. We identify and examine only the alternatives that are most cost-effective, and most feasible from an environmental, economic, and political perspective.[1] It should be noted that we do not discuss agricultural water use in this report, which accounts for about 20 percent of the member agencies' use. While an analysis of agricultural use was outside the scope of this report, a detailed assessment of the potential to improve efficiency of agricultural water use is strongly encouraged.

The following analysis is based on best available information collected from California Urban Water Conservation Council (CUWCC) Best Management Practices (BMP) reports, Department of Water Resources Urban Water Management Plans (UWMP), Water Conservation Plans required through U.S. Bureau of Reclamation (BoR) contract, and direct contact with the member agencies. The reports to the DWR and BoR are mandatory, (the CUWCC reports are mandatory if the agency is a signatory) but it is

[1] We did not include in our analysis options that, under current conditions, would not be cost effective, devices that are new to the American market such as dual-flush toilets, or measures that are politically sensitive, such as rate structures.

relevant to note that their accuracy, completeness, and quality vary widely as does the quality of data collected and available from the member agencies.[2]

Table 1 shows year 2000 water use for the five member agencies. There is considerable variation in per-capita water use among the agencies, with that of Montecito and Santa Ynez more than double that of the other agencies. During the drought in the early 1990s, the City of Santa Barbara (SB) and Goleta Water District (GWD) implemented aggressive water-conservation programs as a way of reducing demand. Although there has been some rebound in demand post-drought, many of the measures, such as toilet-replacement programs, had permanent effect on reducing demand. Prior to the drought, per-capita residential use in SB was 120 gallons per day (gpd). During the height of the drought it was reduced to 71 gpd, and currently it stands at 88 gpd.[3] In Goleta prior to the drought, water usage reached as high as 15,175 AFY, dropped to a low of 8,152 AFY in 1991 at the end of the drought, and has since rebounded to about 13,000 AFY.[4] If the most efficient currently available technologies were installed, average residential use could be as low as about 65 gallons per capita per day (gpcd), 35 of which is used indoors.[5]

Table 1: Water Use of Cachuma Contractors (year 2000)

	Population	Total Use (AFY)[6]	Residential Use (GPCD)
Carpinteria[7]	17,900	4,672	87
Goleta[8]	80,000	13,700	82
Montecito[9]	17,278	5,338	201
Santa Barbara[10]	96,628	14,881	85
Santa Ynez[11]	8,920	5,152	231
Total	**217,130**	**24,366**	

Conservation Potential

We quantify conservation potential from only a subset of end uses of water based on current use and estimates of saturation of cost-effective water-efficient technologies. Actual conservation potential is likely to be higher than these estimates. We identified three primary end uses that, based on statewide and regional studies and programs, offer the greatest conservation potential from both a cost- and water-savings

[2] As one example, Santa Ynez only provides information on single-family accounts in its reports to the CUWCC, while the other agencies include detail on multi-family, CII, agricultural, and some even have information on landscape accounts.
[3] City of Santa Barbara, Water Facts. 2002. [Ex. CT 57]
[4] Camp Dresser & McKee. August 2001. Goleta Water District Urban Water Management Plan. [Ex. CT 55]
[5] Gleick, P.H., D. Haasz, C. Henges-Jeck, V. Srinivasan, G. Wolff, K. Kao-Cushing, A. Mann. 2003. Waste Not Want Not: The Potential for Urban Water Conservation in California. Pacific Institute for Studies in Development, Environment, and Security, Oakland, California. In press. [Ex. CT 63]. See also, Mayer, P.W., W.B. DeOreo, E.M. Opitz, J.C. Kiefer, W.Y. Davis, B. Dziegielewski, and J.O. Nelson. 1999. Residential End Uses of Water. Final Report. AWWA Research Foundation. Denver, Colorado. [Ex. CT 66].
[6] Total of all urban uses: residential, commercial, industrial, and institutional.
[7] Carpinteria Valley Water District. April 2001. Carpinteria Valley Water District Urban Water Management Plan and Water Shortage Contingency Plan. [Staff Ex. 10]
[8] Camp Dresser & McKee. August 2001. Goleta Water District Urban Water Management Plan. [Ex. CT 55]
[9] Montecito Water District Urban Water Management Plan.[Staff Ex. 10]
[10] City of Santa Barbara Public Works Department. December 2000. City of Santa Barbara Urban Water Management Plan. [Staff Ex. 10]
[11] Santa Ynez River Water Conservation District, Improvement District #1 Urban Water Conservation Plan.

perspective: residential and commercial toilets, washing machines, and landscape irrigation. Table 3 summarizes our findings for these end uses. Replacing older inefficient residential and CII toilets with models meeting the current legal standard has the potential reduce current toilet use by 1,500 acre-feet per year. [12] Replacing residential washing machines with more efficient models can save another 900 acre-feet per year. Even greater savings can be achieved by improving the efficiency of water use in landscapes – between 2,800 and 4,600 acre-feet savings can be achieved by better management of urban landscape irrigation. There are many ways in which an agency can promote such conservation, including incentives on conservation technology, education, regulation, rate setting, and information dissemination. We chose to examine ULF toilets, washing machines and landscape irrigation because these programs have already proven to save water, be cost-effective, and be acceptable to the customer. There are many other options, many current and emerging technologies, and various types of incentive programs that an agency can choose to invest in to reduce demand. As a result, these savings estimates should be considered the minimum achievable savings.

Table 2: Summary of Potential Savings by End Use (AF/Yr)

	Residential ULFT	Residential Washers	Landscape (a)	CII Toilets
Carpinteria	145	65	236-377	30
Goleta	449	309	852-1,363	122
Montecito	196	51	540-870	21
Santa Barbara		439	980-1,570	282
Santa Ynez	132	27	247-394	61
Total	**922**	**891**	**2,855-4,574**	**516**

(a) Including improvements in the management of water use in existing landscapes. No changes in turf area or area of water-efficient plants was included here, though these changes can greatly reduce overall water use in landscapes.

Residential Water Use

The residential sector is the largest urban water-use sector, and it offers the largest volume of potential savings compared with other urban sectors. This section describes specific indoor residential end uses and estimates the potential for improving efficiency of those uses with existing technologies.

Residential Toilets

Toilets use more water than any other indoor use, about 32 percent of current indoor residential water use.[13] Replacing old models with 1.6 gallon per flush (gpf) ultra low-flow toilets (ULFT) yields significant savings. While many old inefficient toilets have already been replaced through rebate programs, natural retrofits, and new construction, substantial numbers of inefficient toilets are still in place.

The assumptions we used to estimate potential savings come from two different sources. For SB and Goleta we used CUWCC information on savings per toilet because these were the only two agencies that had information on toilet stock and saturation of ULF models. The CUWCC assumption at 90% confidence is that replacing pre-1980 toilets with toilets that meet the current legal standard saves approximately 42.6 gallons per day. Replacing post-1980 toilets saves 34.1 gallons per day. For multi-family complexes, pre-1980 retrofits save 46.7 gallons/day and post-1980 toilets save 37.4 gallons/day. For the other three agencies we calculated use by population and calculated the distribution of toilets by flushing volume.

[12] Prior to the late 1970s, all toilets typically used six gallons per flush (gpf). Effective January 1, 1978, California state law required that toilets not exceed a flush volume of 3.5 gallons. In 1992, the National Energy Policy Act reduced the maximum flushing volume of residential toilets sold in the United States to 1.6 gallons per flush, effective January 1994. Commercial toilets are now covered as well.

[13] Gleick et al. 2003. [Ex. CT 63].

Population was used as the standard measure, thus eliminating differences associated with toilet use in single-family and multi-family units. Three pieces of information were necessary to evaluate total savings:

- The proportion of the population living in new housing;
- The natural replacement rate for toilets; and
- The number of toilets actively retrofit by utility programs.

The proportion of the population living in new housing

Since all post-1980 housing requires lower flow toilets by law, the population living in new housing was assumed to be using the more efficient model toilets. Yearly housing estimates provided a figure for the number of new houses each year. All houses built after 1980 are assumed to have 3.5 gallon per flush (gpf) toilets and all homes built after January 1994 are assumed to have 1.6 gpf models. New housing construction estimates are multiplied by the average number of people per household, resulting in yearly estimates for the population living in new houses.

The natural replacement rate for toilets

The natural replacement rate refers to the replacement of equipment due to age and wear. The replacement rate used in our model was four percent per year as proposed by the ULFT subcommittee of the CUWCC (CUWCC 1992), equivalent to a 25-year life for toilets.

The number of toilets actively retrofit by utility programs

Carpinteria, Montecito, and Santa Ynez, unlike Goleta and Santa Barbara, have not had retrofit programs and therefore we assume that all retrofits in these districts have been due to natural replacement. The distribution of toilets was determined by calculating the number of 3.5 gpf and 1.6 gpf toilets that had been installed since 1980 accounting for all new homes and natural replacement. We estimated the total population using low-flow toilets in any given year (Plf) using the following equation:

Equation 1: Number of people using low-flow toilets

$$P_{lf} = \Sigma P_{nr} + \Sigma P_{nh}$$

Where
P is the population for a given year;
Pnr is the population using toilets that have already been retrofit as a result of the normal replacement cycle (see equation below);
Pnh is the population in new housing.

For a given year, the number of people using toilets that have been replaced as a result of the normal toilet replacement cycle is calculated by applying the replacement rate to the population that had not had their toilets replaced by either active or passive programs, nor were they living in a newer home built with efficient model toilets.

Equation 2: Number of people using low-flow toilets installed due to natural replacement

$$P_{nr\,(current\ year)} = (P - \Sigma P_{nr\,(previous\ years)} - \Sigma P_{nh}) * TR$$

where TR is the natural turnover rate.

These calculations were done annually, providing a population distribution by flush volume. Multiplying the population in each category by flush volume and frequency of use generates total water use by year for residential toilets. For the separate estimate of maximum practical savings, 1.6 gpf was used as the flush volume for the entire population. The REUW study found that ULFTs were flushed at a slightly higher frequency than non-ULF toilets. The data show that ULFT toilets were flushed slightly more than five times per person per day, while residents of non-ULF homes flushed about 4.9 times per day.[14] Some recent data suggest that the latest ULFTs have the same flushing frequency as non-ULFTs, but we adopted the more conservative frequency estimates into the analysis. While newer, more efficient toilets are now coming on the market, such as dual-flush toilets that use a different volume of water for liquid and solid waste, or even no-water options, we have not calculated their potential for these agencies. We believe, however, that these new efficient toilets represent additional feasible water savings that could be captured if the need arises.

Our calculations assume that toilets have a life span of 25 years and therefore we conservatively estimate that only six gpf toilets are retrofit through agency programs and natural replacement. It does happen that some old toilets that would likely be replaced as part of the natural replacement cycle are replaced through agency programs. These are called free riders. This assumption has no effect on our estimates of potential savings from full implementation of ULFTs. It is, however, relevant to designing policies to capture cost-effective savings.

We estimate that if all the remaining inefficient residential toilets were replaced, current use in the five districts would be reduced by more than 900 acre-feet per year (AF/yr).

Results by agency

Goleta:

According to its 1997 report to the California Urban Water Conservation Council (CUWCC), the Goleta Water District has met the full requirements of BMP 14.[15] GWD had the most complete information on toilet stock and saturation of ULFTs of the 5 agencies. GWD began requiring 3.5 gpf toilets 4 years before it became a state mandate and in 1985 it began a ULFT rebate program that ran until 1989, replacing 11,190 toilets with 1.6 gpf models. Our calculations show that there are, at most, about 10,000 toilets in the district that are not 1.6 gpf, out of a total stock of 50,000. Because the district started requiring 3.5 gpf models in 1974, most of the "old" stock flushes at this volume. We estimate that the 6 gpf models have approximately all been retrofit, 26% of the stock flushes at 3.5 gpf, and the remainder are ULFTs. These estimates were made assuming that no 6.0 gpf toilets were purchased in the district after 1980 and no 3.5 gpf models were purchased after 1986, in both cases preceding state regulations. Retrofitting all remaining inefficient toilets to ULFT models can save the district up to 450 AFY.[16]

Santa Barbara:

The City of Santa Barbara has also met the full requirements of BMP 14. The City of Santa Barbara had a ULFT replacement program that ran from 1988 to 1995. 18,842 residential toilets were replaced—50% of

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[14] Mayer, P.W., W.B. DeOreo, E.M. Opitz, J.C. Kiefer, W.Y. Davis, B. Dziegielewski, and J.O. Nelson. 1999. Residential End Uses of Water. Final Report. AWWA Research Foundation. Denver, Colorado. [Ex. CT 66].

[15] The CUWCC was created to increase efficient water use statewide through partnerships among urban water agencies, public interest organizations, and private entities. The Council's goal is to integrate urban water conservation Best Management Practices (BMP) into the planning and management of California's water resources. A Memorandum of Understanding was signed by urban water agencies and environmental groups in December, 1991; those signing the MOU pledge to develop and implement fourteen comprehensive conservation BMPs. BMP 14 addresses ULFT replacement. The requirements for BMP 14 are that savings from residential ULFT replacement programs be equal or exceed water savings achievable through an ordinance requiring the replacement high-water-using toilets with ultra-low-flow toilets upon resale, and taking effect on the date implementation of this BMP was to commence and lasting ten years (http://www.cuwcc.org/m_bmp14.lasso). For more information on the CUWCC and the BMPs see www.cuwcc.org [Ex. CT 61]

16 Our calculations were based on CUWCC savings assumptions and Attachment 1-A of the 1997 CUWCC BMP report, which has information on the number of toilets in the service area. The mix of single-family and multi-family toilets was proportional to the mix of these housing units across the district. [Ex. CT 60]

MF units and 34% of SF units —saving approximately 657 AFY.[17] According to our calculations, there is probably only a negligible amount to be saved through accelerating replacement, as most models are currently ULFTs.

Carpinteria, Montecito and Santa Ynez:
None of these three agencies have had any active toilet retrofit programs. As a result, the only ULFTs in place are the result of new construction after the state and national standards were put in place, plus toilets replaced due to natural replacement during remodeling and individual efforts. As a result, the saturation results are the same for each of the districts. The distribution of toilets by flush volume is estimated as follows: 10% at 6gpf, 74% at 3.5 gpf and 16% at 1.6 gpf. Based on these data, Carpinteria, Montecito, and Santa Ynez can save about 145, 196, and 132 AF/yr respectively by replacing inefficient toilets.

Washing Machines

High-efficiency (HE) washing machines can save a typical household about 7,000 gallons of water a year[18], cutting per-capita indoor use by 6 to 9 percent.[19] The vast majority of residential washing machines in the U.S. are top-loading machines that immerse the clothes in water and spin around a vertical axis. Horizontal-axis designs use a tumbling action where the washer tub is only partially filled with water, requiring far less water, energy, and detergent.[20] Horizontal-axis washing machines, long popular in Europe where they have captured over 90 percent of the market, have only recently been introduced to the United States. HE machines did not begin to appear in significant numbers in the United States until the late 1990s, but are now increasingly available and popular. For example, in 1999, an estimated 10,000 rebates were issued for high-efficiency washers in California (based on reporting data from the CUWCC); in 2002 more than 24,000 rebates were awarded, and a total of 64,000 rebates have been awarded in the four years since 1999.[21]

Rising pressure on water and energy resources nationwide has prompted detailed field and laboratory surveys evaluating savings from the use of more efficient washing machines[22]. The High Efficiency Laundry Metering and Marketing Analysis project (THELMA) consisted of both a lab and field analysis of machines currently available on the market. Separately, the Department of Energy and the Oak Ridge National Laboratory conducted a five-month field study in Bern, Kansas involving 103 machines and over 20,000 loads of laundry. Both studies yielded similar results: water savings of about 15.7 gallons per load.[23]

17 CUWCC BMP Retail Water Agency Annual Report. 2000. [Ex. CT 59]

[18] U.S. Environmental Protection Agency (USEPA). 2002. Water Conservation Plan Guidelines: Water Use Efficiency Program. Appendix B: Benchmarks Used in Conservation Planning. http://www.epa.gov/owm/water-efficiency/wave0319/appendib.pdf [Ex. CT 69]

[19] Mayer et al. 1999. [Ex. CT 66]

20 For typical usage, 80-90 percent of the energy use attributed to clothes is used to heat water. The partial filling of the tub means less total water is required, less hot water, and less water-heating energy (DOE 1990 in http://www.ci.seattle.wa.us/util/recons/papers/p_sh1.HTM).

[21] Dickenson, M.A. 2003. Executive Director, California Urban Water Conservation Council. Personal communication.

[22] Consortium for Energy Efficiency (CEE). 1995. Consortium for Energy Efficiency High Efficiency Clothes Washer Initiative Program Description. Consortium for Energy Efficiency. Boston, Massachusetts. U.S. Department of Energy (USDOE). 1996. Energy Conservation Program for Consumer Products: Test Procedure for Clothes Washers and Reporting Requirements for Clothes Washers, Clothes Dryers, and Dishwashers. 61 Federal Register 17589. Washington, DC. THELMA. 1998. The High-Efficiency Laundry Metering and Marketing Analysis. A joint venture of the Electric Power Research Institute, U.S. Department of Energy, U.S. Bureau of Reclamation, and two dozen electric, gas, water, and wastewater utilities. EPRI final report, 1998. Palo Alto, California.

23 The two studies used a similar experimental design, the Bern study, however, examined only one efficient washing machine model while the THELMA study used three different H-axis models.

Water savings from efficient machines are generally estimated to be between 40 and 50 percent.[24] This potential has encouraged many utilities nationwide to offer incentives for purchase of efficient washing machines as part of their conservation programs.

Information on the penetration of washing machines and frequency of use came from the 1995 American Housing Survey,[25] which found that 86 percent of households in the city of Santa Barbara have washing machines and we assumed this to be the same throughout the study area. We also assumed that 15 percent of new machines are HE and have a lifetime of 12 years, based on Energy Star estimates.[26]

Summary of Assumptions for Washing Machine Analysis:

- Water savings from retrofit to HE models are 15.7 gallons per machine.
- The penetration of efficient washing machines prior to 1998 is negligible.
- Machine lifetime is 12 years.
- Fifteen percent of new machines now sold in the study area are HE.
- Frequency of use is 0.96 loads/household/day.[27]
- The persistence of water savings from high-efficiency machines has not yet been analyzed. We assume the savings remain consistent through time.

Results for washing machines:

Using the assumptions above, we calculated the number of washing machines for each agency and the savings if all machines were to be replaced with average HE models. There have been no active retrofit programs in any of the agencies to date so we were calculated a standard saturation and turnover across the study area. Using these assumptions, we estimate that replacing inefficient residential washing machines can save nearly 900 AF/yr. We note that additional savings, not computed here, can be captured by replacing inefficient commercial washing machines as well (see discussion below).

Table 3: Water Savings from Retrofit of Residential Washing Machines

	Potential Savings (AF/yr)
Carpinteria	65
Goleta	309
Montecito	51
Santa Barbara	439
Santa Ynez	27
Total	**891**

[24] Hill, S., Pope, T., and R. Winch. 1998. THELMA: Assessing the Market Transformation Potential for Efficient Clothes Washers in the Residential Sector. [Ex. CT 65] http://www.ci.seattle.wa.us/util/recons/papers/p_sh1.HTM. Pugh, C.A. and J.J. Tomlinson. 1999. "High efficiency washing machine demonstration, Bern, Kansas." CONSERV 99 Conference, Monterey, California.

[25] U.S. Census Bureau. 1995. American Housing Survey. AHS-N data Chart Table 2-4. http://www.census.gov/hhes/www/housing/ahs/95dtchrt/tab2-4.html [Ex. CT 68-C]

[26] http://www.energystar.gov/index.cfm?c=clotheswash.pr_clothes_washers [Ex. CT 62]

[27] We used an average of the following three studies:

Koomey, J.G., C. Dunham, and J.D. Lutz. 1995. "The effect of efficiency standards on water use and water heating energy use in the U.S.: A detailed end-use treatment." Energy-The International Journal. Vol. 20, no. 7. p. 627; U.S. Environmental Protection Agency (USEPA). 2002. Water Conservation Plan Guidelines: Water Use Efficiency Program. Appendix B: Benchmarks Used in Conservation Planning http://www.epa.gov/owm/water-efficiency/wave0319/appendib.pdf [Ex. CT 69]; and

Mayer, P.W., W.B. DeOreo, E.M. Opitz, J.C. Kiefer, W.Y. Davis, B. Dziegielewski, and J.O. Nelson. 1999. Residential End Uses of Water. Final Report. AWWA Research Foundation. Denver, Colorado. [Ex. CT 66]

Landscape

Landscape water use in Santa Barbara County is estimated to account for about 59% of total residential use.[28] SB County has a Mediterranean climate with generally warm, dry summers and cool, wet winters. Residential landscaped areas range from 2,000 square feet to three acres and over 50% of these lots have irrigation controllers.[29] Properties in SB and Goleta have large landscaped areas averaging about 0.5 acres and use 37,400 to 224,400 gallons per month (0.1 to 0.7 AF per month) during the summer.[30]

Outdoor residential water conservation and efficiency improvements have the potential to significantly reduce total water demand and improve supply reliability by reducing both average and peak demand. Savings will result from improved management practices, better application of available technology, and changes in landscape design away from water-intensive plants. In addition to the water-supply benefits, there are important water-quality benefits to proper landscape maintenance and irrigation. These include a reduction in energy and chemical use, mowings and other maintenance needs, and waste created.[31] In fact, part of the impetus for the landscape irrigation studies in southern California has been due to the runoff and pollution problems associated with overwatering residential landscapes. Overwatering leads to contamination of local waterways with fertilizers, pesticides, and herbicides.

In 2001, both the City of Santa Barbara and Goleta Water District applied to CALFED's water-use efficiency program for funding for a distribution and installation program for the Weather Trak ET controller. Savings estimates of 25% from the ET controllers were based on a pilot study conducted in Irvine, whose climate and landscape practices are comparable with those of the SB area. The Irvine study showed a 57 gpd savings based on a 3,000 sq. ft. landscaped area. The proposal calculates the cost-benefit ratio of the controller program as 1:1.4.

ET controllers programs are attractive for agencies because they circumvent the "behavioral"[32] issues associated with landscape maintenance, but there are a variety of other options for agency programs. A recent study (Gleick et al. 2003) estimated that landscape water-use reductions of 25 to 40 percent could be made with improved management practices and available technology, economically and relatively quickly.

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[28] Mayer, P.W., W.B. DeOreo, E.M. Opitz, J.C. Kiefer, W.Y. Davis, B. Dziegielewski, and J.O. Nelson. 1999. Residential End Uses of Water: Final Report. AWWA Research Foundation. Denver, Colorado. [Ex. CT 66]

[29] Almy, R. 2001. Santa Barbara County Distribution and Installation Program for the Weather TRAK ET Controller. CALFED Water Use Efficiency Proposal Solicitation Package. [Ex. CT 53]

30 Ibid.

[31] For more information on the co-benefits of proper landscape maintenance see: Moller, P., K. Johnston, and H. Cochrane. 1996. Irrigation Management in Turfgrass: A Case Study from Western Australia Demonstrating the Agronomic, Economic, and Environmental Benefits. Presented at the Irrigation Association of Australia, National Conference, Adelaide, Australia. May 14 to 16 1996. (Agrilink Water Management Services): http://members.iinet.net.au/~agrilink/turf.html);
Nelson, J.O. 1994. Water Saved by Single Family Xeriscapes. Paper presented at the American Water Works Association National Conference, June 22, 1994, New York, New York; and
Sovocool, K.A. and J.L. Rosales. 2001. A Five-Year Investigation into the Potential Water and Monetary Savings of Residential Xeriscape in the Mojave Desert. 2001 AWWA Annual Conference Proceedings, June. Southern Nevada Water Authority, Nevada, (working paper supported by the Southern Nevada Water Authority and the US Bureau of Land Management). Available at http://www.snwa.com/assets/pdf/xeri_study.pdf. [Ex. CT 68-A]

[32] Efficient irrigation involves two things: proper design and proper landscape maintenance. Proper landscape maintenance requires that the homeowner be informed and diligent — difficult things for an agency to predict, control, or monitor. When an agency decides whether to invest in a retrofit program, they can reliably calculate savings from switching their existing stock to ULFTs and from that determine the costs and benefits of such a program. A similar evaluation of landscape programs is more difficult and is constrained by lack of data and consistency in homeowner behavior.

even without changes in landscape design and plant type. Many options are available for reducing residential landscape water use, including new technologies, better management approaches, and appropriate garden designs.[33]

Three of the agencies — Santa Barbara, Goleta, and Montecito — had information on water sales by month, which allowed us to use the "minimum month" method of estimating outdoor water use. This method assumes that the lowest use month represents indoor use. Use above that value is categorized as outdoor. The underlying, and conservative, assumption is that there is a month in which there is no landscape irrigation. Using this method, we found the percentage of outdoor use to be lower than the estimate from the REUW analysis. We combined all urban uses together in this calculation (we did not do separate calculations for residential and CII accounts) and to this outdoor water use value we applied a potential reduction range of 25 to 40 percent based on experience from regional case studies, audits, and technology assessments.[34]

For the City of Santa Barbara we averaged data on metered water sales by month for 2001 through 2003, and subtracted agricultural uses to get urban use by month. Our results indicate that about 3,900 AF per year are used for landscape irrigation, accounting for almost 50% of urban use in the warmest month. Savings potential in Santa Barbara ranges from 980 to 1,570 AF per year. Goleta had monthly data from 1997-2002 and we estimate that about 3,400 AF is used annually for landscape irrigation, yielding a savings potential of 850 to 1,360 AF per year. Montecito had monthly data from 1968 to 2003 and the highest percentage of outdoor use of the three, reaching 68% during the warmest months. We estimate Montecito's landscapes use at about 2,160 AF/yr, which can potentially be reduced by 540 to 870 AF per year.

Carpinteria and Santa Ynez do not have accessible information on outdoor use, so estimates for these two districts were based on the information from the other three agencies. For Carpinteria we used the average urban water use for 1990, 1995 and 2000[35] (2,483 AFY) and applied to this the average outdoor use from Santa Barbara, Goleta, and Montecito (38%) to get an average annual outdoor water use of 944 AF. From this we estimate a potential savings of 236 of 377 AF per year from landscape improvements. We used the same procedure for Santa Ynez and found that outdoor uses account for just under 1000 AFY, yielding a potential savings of 247-394 AF per year.

Commercial, Industrial and Institutional (CII) Water Use

Conservation programs within the member agencies have targeted primarily residential water users and therefore the CII sector still offers considerable potential for water savings. As part of their ULFT rebate programs, the City of SB and Goleta Water Districts offered rebates for CII toilets between 1988 and 1994. Santa Barbara replaced 2,995 toilets (14% of pre-1993 stock and Goleta has replaced about 690 units. There remain a large number of CII customers with potential for significant water savings, which we estimate at about 516 AFY.

CII Toilets

The CUWCC has 1992 data on number of toilets by zip code broken down by sub sector, which we used to estimate the amount of water that could be saved from replacing CII toilets. To these 1992 numbers we calculated a 4% turnover rate per year to capture toilets naturally retrofit. For Santa Barbara and Goleta, the only agencies that have had active retrofit programs, we estimated the number of toilets retrofit by sector based on the assumption that the retrofits occurred proportionately. For example, 9 percent of Goleta's CII

[33] For more information on the various landscape conservation options and estimates of costs and savings, see Gleick et al. 2003. [Ex. CT 63]
[34] See Gleick et al. 2003 [Ex. CT 63]
[35] Carpinteria Valley Water District Urban Water Management Plan and Water Shortage Contingency Plan. 2001. [Staff Ex. 10]

toilets are in hotels and therefore we assumed that 9% of the 690 units replaced were also in hotels. For the actual savings estimates we used values from the county's (with the City of Santa Barbara participating) CALFED funding application for CII rebate programs for ULFTs, waterless and ULF urinals, and high-efficiency commercial clothes washers. These estimates, found in Table 5, are based on information from MWD programs. Tables 6 and 7 show the results across the five agencies by CII subsector and by agency.

Table 4: Savings per ULFT Installation by Market Segment

Market Segment	Savings per installed ULFT (gpd)
Category 1	
Wholesale	57
Food store	48
Restaurant	47
Category II	
Retail	37
Automotive	36
Multiple Use	29
Religious	28
Category III	
Manufacturing	23
Health care	21
Office	20
Miscellaneous	17
Hotel/motel	16
School	18

Source: Urban Water Conservation Grant Application, CII ULFT Savings Study, CUWCC 2001

We used the following equation to estimate water savings from CII retrofits:

Equation 3:

[Ts-(Tnr+Tar)]*Ss, where

Ts is the number of toilets by subsector;
Tnr is the number of toilets naturally retrofit (4% per year);
Tar is the number of toilets actively retrofit, and
Ss is the savings per toilet by subsector in gallons per day.

Table 5: Member Agencies' CII Toilet Numbers and Potential Water Savings by Subsector

CII Subsector	Total Number of toilets (1992)	Number of toilets naturally retrofit (through 2002)	Number of toilets actively retrofit (through 2002)	Number of toilets remaining to be retrofit (2002)	Potential Savings (AF/Yr)
Hotels	7,357	2,943	726	3,688	65
Eating Establishments	1,105	442	118	545	28
Health Sector	3,413	1,365	414	1,634	38
Offices	9,341	3,736	1,077	4,528	100
Retail/ Wholesale	8,987	3,595	932	4,460	195
Other	2,504	1,002	229	1,274	24
Industrial	2,457	983	256	1,219	31
Churches	666	266	71	329	10
Government	944	378	100	466	13
Schools: K to 12	995	398	97	500	11
Total	**37,770**	**15,108**	**4,019**	**18,643**	**516**

Table 6: CII ULFT Savings Potential by Agency and Subsector (AF/yr)

CII Subsector	Goleta	Carpinteria	Santa Barbara	Montecito	Santa Ynez
Hotels	7	2	38	2	16
Eating	6	2	16	1	3
Health	9	1	26	1	2
Offices	26	6	60	3	5
Retail/ Wholesale	40	11	108	10	26
Other	6	2	11	3	4
Industrial	18	4	8	0	1
Churches	2	1	6	0	1
Government	3	1	7	0	2
Schools: K to 12	4	1	4	0	1
Total	**122**	**30**	**282**	**21**	**61**

Commercial Washers

None of the five agencies have information available on the penetration rate of commercial washers so we could not estimate the potential of replacing existing models with high-efficiency machines. Santa Barbara County requested a CALFED grant, effective 2003, to fund a CII washing machine rebate program. They plan to rebate about 176 washers and estimate an annual water savings of 156 AF at a cost of $215/AF and benefit: cost ratio of 1:1.47.

Cost-Effectiveness of Water Conservation

The previous sections identify the range of conservation and efficiency improvements that are achievable in the member agencies' urban sector using proven, publicly acceptable technologies and options. This section presents our assessment of the cost of those technologies and options.[36] Since each water conservation measure is an alternative to a different source, or a new or expanded physical water supply, conservation measures are considered cost effective when their cost -- which we call "the cost of conserved water" -- is comparable the cost of other water-supply options. There are a variety of ways of computing this cost. Readers should look at Gleick et al. (2003) for detailed discussion.

Table 7 shows member agencies' avoided cost of water[37] from the different supply sources, which range from about $200 to $400 per acre-foot. The variable cost is the amount paid by the agencies for each acre-foot purchased. The difference between unit cost and variable cost is called "fixed costs," which is the amount paid by the agency regardless of whether they receive the water or not. For example, about three-quarters of the unit cost of water from the State Water Project are fixed and used to recover, among other things, the $600 million it cost to build the pipelines, pumping, and treatment plants importing SWP water to the county.[38] Regardless of whether agencies take their entitlement, they are liable for these costs. Therefore, unless agencies are looking at major supply shortages in the future that require new projects to be built or expanded (which the Cachuma contractors are not), the avoided cost of water is the variable cost and the cost of conservation alternatives should be compared to this.

Table 7: Avoided Cost of Water ($/AF)

	Groundwater	Cachuma Purchased	Cachuma (Spill)	State Water (exchanged)	State Water (purchased)	Desalination
Variable Costs						
Purchase	-	100.00	-	100.00	210.00	
Treatment	4.89	188.43	188.43	188.43	188.43	
Power	104.89	-	-	-	-	
Operation & Maintenance	13.41	-	-	-	-	
Capital Cost recovery	75.01					
Total Variable Cost	**198.20**	**288.43**	**188.43**	**288.43**	**398.43**	**1,100**
Unit Cost of Water[39]	915	412			1,745	1,500

Table 8 shows the unit cost of water for various conservation alternatives as presented in a proposal submitted by the County to CALFED and DWR for CII ULFT/washing machine and landscape conservation programs. We have also calculated in a separate analysis[40] the costs for residential ULFTs and washing machines as $50 and $-74 per acre-foot,[41] respectively. According to our calculations, as well as

[36] For an explanation of how this analysis was developed, the assumptions and the results, see Gleick et al. 2003. [Ex. CT 63]

[37] Cost that could be avoided if the agency used a different source of supply.

[38] Santa Barbara County Water Agency. July 2000. Water Resources of Santa Barbara County. [Ex. CT 68]

[39] Includes fixed costs. Based on data from Goleta Water District. 2002-2003. Sources of Water Supply Costs. Memo from Kevin Walsh. [Ex. CT 64]

[40] Gleick et al. 2003 [Ex. CT 63]

[41] We include reasonably quantifiable and financially tangible "co-benefits" of water conservation as "negative costs" (i.e., as economic benefits). A negative value for cost of conserved water means that water could be free and customers would still save money by implementing the conservation option. This happens when non-water benefits, or "co-benefits" are sufficient by themselves to pay for the water conservation investment. Co-benefits are benefits that automatically come along with the intended objective. For example, high efficiency washing machines reduce water-heating bills and sewage costs,

those of the County, all conservation alternatives are at least comparable to member agencies' other sources of supply (even though the County estimates do not include co-benefits). The one exception is commercial clothes washers, which according to our analysis, has a cost of about $325/AF. The discrepancy between the two results can be explained, at least in part, by the fact that our analysis internalizes energy and wastewater savings. Thus, the estimates in Table 8 are, we believe, highly conservative – in fact, the cost of conserved water is likely to be substantially below these numbers. Yet even these estimates show that the conservation potential we identify is cost effective.

Table 8: Cost of Conservation Alternatives

	Average Cost to Purchase Product	Average Lifetime Savings (AF)	Administrative and Marketing Cost	Cost of Conserved Water ($/AF)
ET Controller[42]	$200	9.312	$362	$60
Category I Tank[43] Type ULFT	$100	1.223	$28	$105
Category I Flushometer ULFT	$200	1.223	$28	$186
Categories 2&3 ULFT	$150	.654	$28	$272
Waterless Urinals	$450	1.646	$28	$290
Commercial Clothes Washer	$1000	.543	$28	$1,893

These are costs to the water agencies. Costs to consumers are likely to be different, and often lower. And these costs do not include co-benefits such as energy savings, which are especially important for clothes washers.

Supply and Demand Assumptions in the EIR

For all agencies, water supplies are expected to be adequate through 2020 and beyond in all but a worst-case scenario critical drought year. Member agencies' demand and supply from all sources is presented in Table 9.

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and improved irrigation scheduling reduces fertilizer use. We have not evaluated all co-benefits, only those that could be quantified in a reasonably objective fashion. Even so, our results are much more favorable for water conservation than less complete assessments that exclude such co-benefits. Including co-benefits dramatically affects the results we achieve; helping to explain why conservation is more economically desirable than some previous analyses have suggested.

[42] Almy, R. 2001. Santa Barbara County Distribution and Installation Program for the Weather TRAK ET Controller. CALFED Water Use Efficiency Proposal Solicitation Package. [Ex. CT 53]

[43] Almy, R. Santa Barbara County CII Rebate Program. Proposal to CALFED. [Ex. CT 54]

Table 9: Water Supply and Demand Conditions for Cachuma Project Member Units[44]

	Carpinteria	Goleta	Montecito	Santa Barbara	Santa Ynez	***Total***
Supply						
Cachuma Project (%)[45]	2,813 (22%)	9,321 (58%)	2,660 (34%)	8,277 (45%)	2,651 (22%)	25,722
State Water Project	1,000[46]	3,800-7,000[47]	2,208[48]	2,566[49]	1,000[50]	10,574-13,774
Groundwater	3,000	2,350	400	1,400	4,700	11,850
Reclaimed		1,500				1,500
Desalination				3,125		3,125
Other			2,375	6,063	3,600[51]	12,038
Total Supply	6,813	16,971-20,171	7,715	18,306[52]	11,951	61,756-64,956
Demand (average)						
Current (2000)	4,672	14,000	6,073	15,140	5,300	45,185
Build Out (2020)	5,423	16,000	6,835	15,570-17,760	9,050	52,878-55,068
Difference (supply-demand)	2,141-1,390	2,971-4,171	1,642-880	3,166-1,640	6,651-2,901	16,571-10,982

There are two major questionable assumptions in the supply and demand section of the EIR. The first is the demand assumptions and projections for the member agencies. The EIR indicates that mitigation alternatives are capable of meeting 2020, critical dry year demand (alternatives 2 and 4A-B). This projected critical dry year demand is based on current demand levels, which from the previous sections, we know can, and probably will be reduced due to continued investment in conservation programs as well as naturally occurring conservation from mandated efficiency. Shortage (in all alternatives) occurs only when the projections show increase in per capita demand in 2020. Agencies' demand projections do not appear account for continued investment in conservation measures that would reduce demand. In fact, projected per-capita residential demand actually rises for four of the five agencies (demand declines slightly for Santa Ynez, which, at over 200 AFY, would still be more than twice that of Santa Barbara or Goleta). Table 10 shows how forecasted demand is increasing at a faster rate than population. While demand is projected to increase by about 23% between 2000 and 2020, population is projected to increase by only 15%. Per capita demand should be decreasing, rather than increasing, as conservation technologies continue to penetrate the market. Efficient toilets will replace older models, washing machines will continue to capture an increasing

[44] State Water Resources Control Board, Division of Water Rights. August 2003. Draft Environmental Impact Report. Consideration of Modifications to the U.S. Bureau of Reclamation's Water Right Permits 11308 and 11310 (Applications 11331 and 11332) to Protect Public Trust Values and Downstream Water Rights on the Santa Ynez River Below Bradbury Dam (Cachuma Reservoir).

45 Member agencies' annual deliveries from the Cachuma Project are calculated as a percentage of the total supply provided.

[46] Entitlement is 2,000 AFY (50% average annual delivery) plus 200 AFY of drought buffer.

[47] GWD assumes 51-60% average annual delivery of entitlement (7,000 AFY) and drought buffer (450 AFY). Current diversion is limited to 4,500 AFY due to pumping capacity.

[48] MWD assumes 76% average annual delivery of entitlement of 3,000 AFY plus 300 AFY drought buffer.

[49] City assumes 76% average annual delivery of entitlement (3,000 AFY) plus 300 AFY of CCWA drought buffer.

[50] Entitlement is 2,000 AFY plus 50 AFY drought buffer.

[51] Santa Ynez River underflow. Maximum permitted amount is 6,115 AF.

[52] Does not include desalination, which is considered only an emergency supply.

share of the market[53] and a host of other practices and technologies that use water more efficiently will continue to be adopted.

Table 10: Past, Current, and Projected Water Use and Population[54]

	1990	1995	2000	2005	2010	2015	2020
Total water demand (AFY)	23,705	35,337	40,481	39,820	44,496	46,562	48,698
Residential use (AFY)	12,741	20,779	24,366	25,811	27,336	28,912	30,557
Total excluding agriculture (AFY)	17,397	28,263	32,058	33,885	35,725	37,602	39,542
% Change in urban demand from 2000	-51.3%	-20.9%	0.0%	5.7%	11.4%	17.3%	23.3%
Population			221,476	230,428	238,849	246,880	255,409
Total Per capita (gpcd)			171	172	173	175	176
Residential Per capita (gpcd)			98	100	102	105	107
Population growth from 2000			0%	4%	8%	11%	15%

The other problem with this section of the EIR is the focus on the 1951critical dry year as a basis for decision-making. Using 1951 to represent a critical drought year, the EIR examines the potential shortages experienced by the member agencies. Member units' have sufficient supply to meet demand in all years out of the 1918-1993 period analyzed except for 1951, including during a three-year drought period. During this kind of critical drought year, emergency measures are implemented. There are a number of alternatives that could and should be considered in order to meet critical drought year shortages but using this scenario to drive the planning process is not reasonable.

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53 AB 1561, which is awaiting final approval, requires all newly manufactured home washers in California not to exceed a water factor of 9.5. The new standards would save about a typical family about 7,000 to 9,000 gallons per year.

54 From agency Urban Water Management Plans.

Conclusions

According to our analysis, serious efforts to implement cost-effective conservation and efficiency programs will give the Cachuma member agencies ample flexibility to mitigate the impacts of the scenarios proposed in the EIR to maintain the endangered steelhead populations on the Santa Ynez River. In addition, impacts to water supplies caused by alternatives that involve greater releases of water than proposed in the EIR can also be mitigated. We estimate between about 5,000 and 7,000 AFY of water can be cost-effectively conserved by programs to implement the conservation measures described in this report. Demand can be reduced so that the impacts of a critical dry year are considerably less severe.

More importantly, the EIR's analysis of water supply and demand is inadequate. A thorough assessment of the proposed alternatives' impacts should include not only various supply scenarios, which it does, but a section of demand scenarios as well. The EIR presents supply and demand conditions based on current demand and the projected member units' demand increases. Missing are demand projections with different, and we believe, realistic levels of conservation. As a result, the scenarios are limited to the single projection of agencies, some of who have shown little interest in conservation. Finally, the decision-making in the EIR seems to revolve heavily around the catastrophic critical dry year scenario that, in reality, would call for a variety of drought emergency measures and is not typically used as the basis for long-term planning.