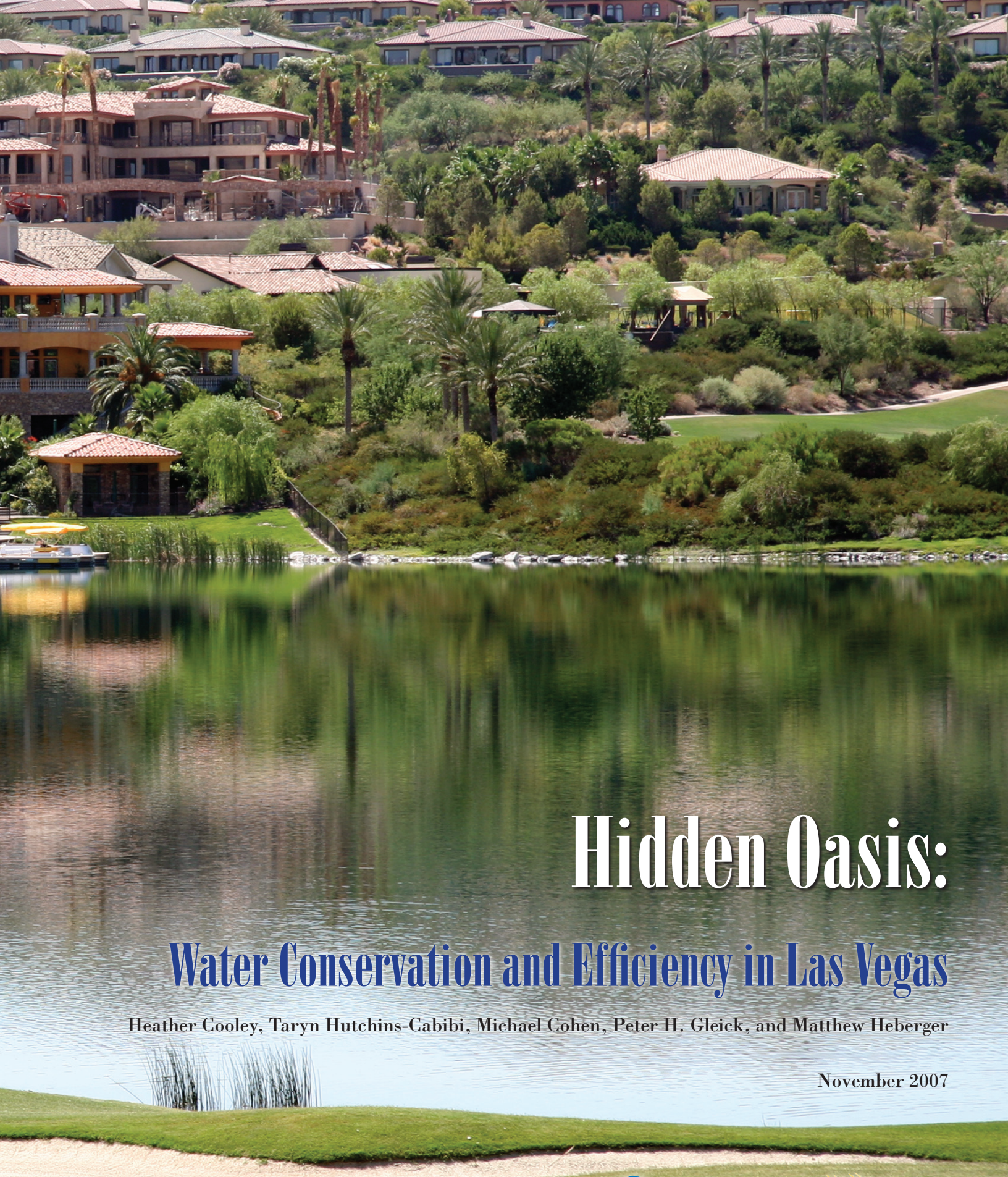

Hidden Oasis:

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WESTERN RESOURCE ADVOCATES

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Appendix A Overview of Conservation Programs

The member agencies of the Southern Nevada Water Authority (SNWA) implement a range of water conservation programs to reduce water waste. These programs are described below.

Rebates and Incentives

- **Indoor Test Kit:** The SNWA offers free indoor water audit kits that include a water-flow measuring bag for showerheads and faucets and a toilet leak detection tablet (SNWA 2007a). For customers with high consumption levels, SNWA can offer additional assistance, including field visits, information, and incentives.

- **Indoor Fixture Retrofit Kits:** The SNWA offers free fixture retrofit kits to customers with homes built prior to the 1989 ordinance requiring low-flow fixtures (SNWA 2007a). The retrofit kits include faucet aerators, leak detection tablets, a toilet flapper, and a low-water use showerhead. Although heavily promoted in 1997 and 1998, this program has served over 15,000 homes[1]—a relatively small number of households. The SNWA contends that participation in this program is low due to market saturation (Sovocool 2007).

- **Water Conservation Education:** The SNWA offers several programs to educate citizens and contractors about water conservation efforts they can implement. In 2003, the Water Smart Contractor program was initiated to train contractors to use methods that improve landscape water efficiency on new landscape installations and retrofits. The SNWA has implemented a school water education program that trains teachers, creates a youth advisory council, and provides classroom materials to educate students on water conservation. In addition to these programs, SNWA provides publications, videos, informational websites, and a helpline to keep

[1] K. Brothers, SNWA, personal communication, October 9, 2007.

citizens informed of current water-related issues. The SNWA also operates several demonstration gardens, including the 3.5-acre Gardens at Springs Preserve, which offer free admission and gardening classes (WRA 2003).

- **Water Efficient Technologies (W.E.T.) Program**: This W.E.T. program offers monetary incentives up to $150,000 for businesses and multi-family property owners who install water-efficient technologies that provide at least 500,000 gallons of annual water savings. Each technology must have a minimum lifespan of 5 years. Technologies that reduce consumptive use can earn $10 for every 1,000 gallons conserved annually, whereas those that reduce non-consumptive use can earn $2.50 for every 1,000 gallons conserved annually. Developers can also earn rebates for installing appliances and fixtures that exceed current national efficiency standards. Since 2002, this program has provided rebates to 30 projects with an estimated cumulative water savings of 1.2 billion gallons, or 3,600 acre-feet (Sovocool 2007).

- **Water Smart Home Program:** In 2005, the SNWA launched the Water Smart Home program to encourage developments to utilize water-efficient technologies and limit turf and pool areas. Individual homes and entire development projects that participate in the program may be designated "Water Smart." According to SNWA, "a Water Smart Home may save as much as 75,000 gallons of water each year compared to homes built a decade ago" (SNWA 2007b). Since the program's inception in 2005, a total of 5,000 homes have been built with the Water Smart label,[2] equivalent to 1 out of every 6 homes built in the Las Vegas Valley during this period.[3]

- **Water Upon Request Program:** Designed to build awareness of water waste through collaboration with the restaurant industry, the Water Upon Request program encourages waitstaff to serve water only when requested.

[2] N. Lise, SNWA, personal communication, May 31, 2007.

[3] K. Brothers, SNWA. personal communication, October 9, 2007.

- **Water Smart Landscape Program:** This rebate program awards the conversion of turf into water-efficient landscapes. For the first 1,500 square feet of converted landscaping, the Water Smart Landscapes rebate program offers $2 per square foot of land converted on either residential or commercial properties.[4] For conversions in excess of 1,500 square feet, the customer is eligible for $1 per square foot. This program saves an average of 56 gallons of water per square foot every year (SNWA 2004).

  Table A-1 shows the number of participants, cost, and water savings of the rebate program. Since it's inception in 2000, the SNWA has paid more than 22,000 participants a total of $71 million (in 2005 dollars) to convert 81 million square feet of turf to water-efficient landscaping (Sovocool 2007). This conversion saves an estimated 13.9 KAF of water annually. If we assume that these savings are maintained for 25 years, then the cost of conserved water is $205 per acre-foot. At the current rebate level of $2 per square foot, the cost of conserved water is $467 per acre-foot. The actual cost is likely smaller, as evidence suggests that less than 0.5% of homes that install water-efficient landscaping revert back to turf.[5]

[4] A minimum of 400 square feet must be converted.

[5] K. Sovocool., SNWA, personal communication, May 30, 2007.

Table A-1 Summary of the SNWA's Landscape Conversion Program

Year	No. Participants	Area Converted (square feet)	Incentive Paid (2005$)	Average $ per sq. ft.	Annual Water Savings (AFY)
2000	262	666,919	419,681	0.63	114
2001	490	2,300,887	981,672	0.43	394
2002	602	3,496,496	1,462,677	0.42	599
2003	2,379	11,866,960	10,846,195	0.91	2,032
2004	8,618	34,067,670	29,545,996	0.87	5,834
2005	5,735	15,386,836	14,236,924	0.93	2,635
2006	3,466	10,710,460	10,602,409	0.99	1,834
2007*	677	2,754,374	3,208,343	1.16	472
Total to Date	**22,229**	**81,250,602**	**71,303,899**	**0.88**	**13,914**

* 2007 figures are through April 30, 2007.
Source: Sovocool 2007

- **Irrigation Timer and/or Rain Sensor Rebate:** Between 1999 and 2004, the SNWA facilitated the implementation of more than 1,500 irrigation clocks that allow multiple watering programs for different landscapes (turf versus woody plants) (SNWA 2004). Since 2004, the SNWA has offered single-family residential customers up to $200 to install new smart controllers, which they estimate reduce water use 10% to 20 percent. Commercial and multi-family residential customers who install smart controllers can receive up to $40 per valve. The SNWA also offers commercial and residential customers up to $25 to install rain sensors, which prevents irrigation from turning on during or after precipitation.

- **Pool Covers**: The SNWA offers rebates for pool covers--up to $50 for a manual cover and $200 for a mechanical cover. They estimate that a pool cover saves 30 gallons of water per square foot per year. Since 2005, 8,453 rebates have been redeemed (Sovocool 2007).

- **Irrigation Audit Program:** Irrigation audits are offered to commercial property owners and managers at no cost. During the audit, conservation specialists check

the efficiency of the irrigation system as well as its past water use history to provide information on reducing water use. For customers with high levels of consumption, further assistance is available, including field visits, information, and incentives.

- **Leak Detection and Repair:** Every five years, the SNWA requires each purveyor to which it provides water to perform a distribution audit so that leaks in the system can be fixed. The Las Vegas Valley Water District, which has a low occurrence of leaks, continuously surveys its system using listening devices that are placed throughout the system.

- **Water Smart Car Wash:** Through its Water Smart Car Wash program, the SNWA provides individuals with $1 and $2 coupons at car washes that recycle water.

Ordinances

- **Landscaping Ordinances:** Landscape ordinances, which were first implemented in the mid-1990s and strengthened in 2003, vary slightly among the SNWA member agencies and the type of development. For new single-family homes, turf area is limited to 50% of the front yard, which includes the driveway and parking area. Only Boulder City limits backyard turf area. For multi-family homes, turf is limited to 30-40% of the landscaped area, and in non-residential developments to 15-30% of the landscaped area. Some areas also limit turf on golf courses. Turf limitations are even stricter for developments constructed during droughts. While implementing stricter regulations during a drought may be more politically feasible, this makes little sense from a conservation perspective as homes built during relatively wet periods will exist during drought periods.

- **Water-Use Ordinances**: Since 2003, the SNWA members have implemented seasonal Water-Use Ordinances that restrict watering schedules, as shown in

Table A-2. While residents may only water on certain days during spring, fall, and winter, they may water any day of the week during the summer, which extends from May 1st until October 1st. Residents with sprinkler irrigation systems are prohibited from watering between 11a.m. and 7 p.m. throughout the year. In lieu of day restrictions, some large customers have been given a landscape water budget. Golf courses, for example, are limited to 6.5 acre-feet per irrigated acre during a drought watch and 6.3 acre-feet per irrigated acre per year during a drought alert.[6] This measure is expected to reduce the golf industry's water use by 10% (SNWA 2004). Golf course operators that exceed their water budgets are subject to stiff penalties. Ornamental water features are prohibited unless otherwise specifically permitted by jurisdictional governmental bodies.

Table A-2 Outdoor Watering Restrictions During a Drought Watch and Drought Alert.

Season	Months	Watering Days
Winter	November-February	1 day per week
Spring	March-April	3 days per week
Summer	May-August	Any day
Fall	September-October	3 days per week

Residents may only water on designated days during the seasons shown.
Source: SNWA 2007c

- **Water Waste Ordinances:** All SNWA members have ordinances or rules against water waste, which they define as "the use of water that results in water flowing into any gutter, street, sidewalk, etc., in a steady stream for an extended period," or "water pooling in a public street, sidewalk or right-of-way." Those found in violation of ordinances may be fined. In 2005, there were nearly 67,000 water waste investigations (WRA 2006).

[6] Golf courses are limited to 5 acres of turf per hole and 5 acres of turf per driving range.

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Appendix D Calculation of Potential Water Savings in Single-Family Homes

Current Single-Family Residential Water Use

In 2004, the Southern Nevada Water Authority (SNWA) delivered more than 198 thousand acre-feet (KAF) of water to customers in single-family homes for indoor and outdoor purposes (WRA 2006). The SNWA estimates that indoor demand for single-family residents is about 30% of total demand. While this estimate is a pre-drought estimate that likely does not reflect current conditions,[1] no better data was available. Furthermore, this estimate is subject to substantial variation because weather is a large determinant of outdoor and subsequently, total demand. In the absence of better data, the Pacific Institute and Western Resource Advocates based indoor water use on a recent end-use analysis of water use in the Las Vegas Valley with some modifications (discussed below). Outdoor demand was then estimated by subtracting the estimate of indoor demand from the total demand of 198 KAF.

Estimates of current indoor water demand are based on a recent study by Aquacraft Inc. (2000). In February and March 2000, Aquacraft Inc. installed data loggers on water meters for 95 homes in Southern Nevada. The data loggers take continuous flow measurements, providing a measure of water use by end use, e.g., toilets, leaks, and showers. This method has been thoroughly tested to ensure that its results are consistent with other methods and was used by the American Water Works Association Research Foundation in its Residential End Uses of Water Study. The 2000 Aquacraft study found that current single-family residential (SFR) indoor water demand in Las Vegas was about 71 gpcd. The largest uses of water were toilets and clothes washers, although leaks and showers also used a significant amount of water (Figure D-1).

[1] K. Brothers, SNWA, personal communication, October 9, 2007.

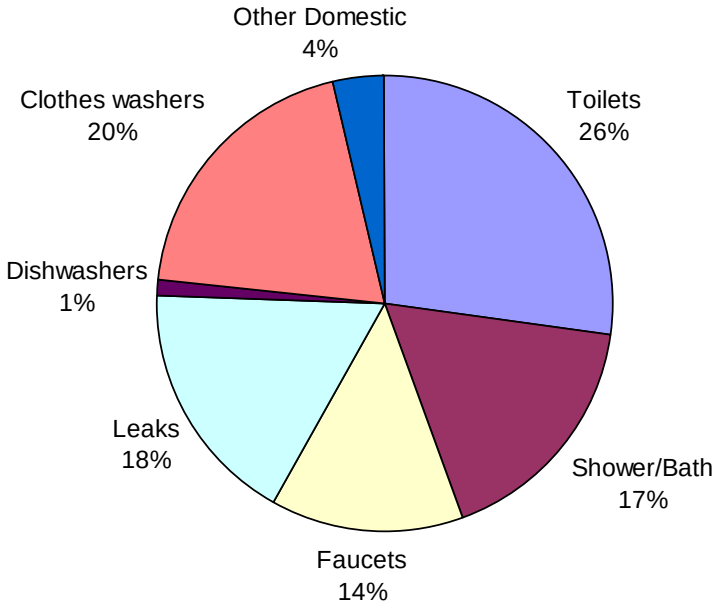

Figure D-1 SFR Indoor Water Demand in the Las Vegas Valley in 2000, By End-Use
Note: Per capita water demand based on end-use analysis in the Las Vegas Valley (Aquacraft 2000).

Actual per capita indoor use in 2004 was likely lower than in the Aquacraft study. The average home in the Aquacraft study was built in 1980, whereas in 2004, the baseline year for this analysis, the average home was built in the early 1990s and is thus more likely to have fixtures that meet current national plumbing standards. As a result, we would expect indoor per capita demand to be lower. For this analysis, we assume that indoor demand is between 60 and 70 gpcd, or about 65 gpcd. We estimate that the demand by end use is maintained at the percentages shown in Figure D-1, e.g., clothes washers account for about 20% of indoor demand, or 12.8 gpcd. We then multiplied these per-capita estimates by the SFR population to obtain total water demand by end use in the Las Vegas Valley (Table D-1). The SNWA is participating in a more detailed study of indoor per capita demand that should be used to estimate the conservation potential with greater accuracy.

Table D-1 Estimated Per Capita and Total Water Demand by End Use in the Las Vegas Valley in 2004

End-Use	2004 Water Demand (gpcd)	2004 Water Demand (KAFY)
Toilet	17.8	21
Shower/Bath	11.0	14
Faucet	8.8	15
Leak	11.4	13
Dishwasher	0.8	1
Clothes washer	12.8	3
Other Domestic	2.3	11
Total	65.0	78

Note: Adequate data on water demand by end use in the Las Vegas Valley is not available. For this analysis, we assume that indoor demand is about 65 gpcd. We estimate that the demand by end use is maintained at the percentages shown in Figure D-1. Total may not add up precisely due to rounding.

Based on the 2004 SFR population, we estimate the SFR indoor water demand in 2004 was 78 KAFY. Given a total SFR water demand of 198 KAFY, we estimate that SFR outdoor demand in 2004 was 120 KAFY, or about 60% of total demand.

Indoor Conservation Potential

To evaluate the indoor conservation potential, we adopted the methods employed in the 2003 Pacific Institute report, "Waste Not, Want Not: The Potential for Urban Water Conservation in California."[2] This study evaluated the various end-uses of water in the home, including toilets, showers and baths, clothes washers, dishwashers, and water lost to leakage (Gleick et al. 2003). We assumed that faucet-use remains constant because this end-use is typically volume based. For each end use, we applied estimates of the quantity of water required for each use and the number of times an appliance or fixture was used based on both federal water-efficiency standards and focused end-use studies. The conservation potential is estimated by subtracting efficient use from actual use.

[2] This study's conclusions have been adopted in the most recent California Water Plan that forms the basis for state water policies and planning. The study can be found at http://www.pacinst.org/reports/urban_usage/.

Table D-1 contains the assumptions about the quantity of water required for each end-use. For toilets and showers, we assumed that efficient fixtures meet current federal standards of 1.6 gallons per flush (gpf) and 2.5 gallons per minute (gpm), respectively. We estimated that actual water use for showers is 67% less than the rated flow (equivalent to 1.7 gpm) because empirical evidence indicates that most people mix hot and cold water but do not open the valves to full capacity (Mayer et al. 1999; Vickers 2001). Although fixtures are available that exceed these federal standards, such as dual-flush or high efficiency toilets, we limited our analysis to the current national plumbing codes. For clothes washers and dishwashers, which are not covered by plumbing codes, we estimated efficient use based on surveys of currently available technologies (Gleick et al. 2003).

Table D-1 Quantity of Water Required for Each End-Use Event

End Use	Value	Units	Data Source
Toilet	1.6	gallons per flush	EPAct 1992
Shower	1.7	gallons per minute	EPAct 1992; Mayer et al. 1999; Vickers 2001
Leaks	4.2	gallons per household per day	Mayer et al. 1999
Clothes washer	26	gallons per load	Gleick et al. 2003
Dishwasher	5.3	gallons per load	Gleick et al. 2003

Note: The Energy Policy Act of 1992 (EPAct) specifies that showerheads must have a maximum rated flow of 2.5 gpm at normal household pressure. However, it has been found that the actual rated flow is about two-thirds (67%) of the maximum rated flow, or 1.7 gpm, because most people do not fully open the throttle during use (Mayer et al. 1999).

Table D-2 contains the assumptions about the frequency of use for each device. These estimates were based primarily on focused end-use studies. We estimated that 63% of households nationally have dishwashers and 82% have clothes washing machines (U.S. Census Bureau 2005). If the prevalence of these appliances is higher in Las Vegas, the potential for efficiency improvements will be higher as well.

Table D-2 Frequency of Water End-Use Events

End Use	Value	Units	Data Source
Toilet	5.04	flushes per person per day	Mayer et al. 1999
Shower	8.5	minutes per shower	Mayer et al. 1999
	0.67	showers per person per day	Mayer et al. 1999, 2000
Clothes washer	0.96	loads per household per day	Gleick et al. 2003
	0.82	machines per household	U.S. Census Bureau 2005
Dishwasher	0.4	loads per household per day	Mayer et al. 1999
	0.63	machines per household	U.S. Census Bureau 2005

We then combine the quantity of water required for each use and the frequency of use (information in Tables D-1 and D-2) to estimate efficient use. For example, we assume that the average person flushes the toilet 5.04 times per day (Mayer et al. 1999). With an efficient 1.6 gpf toilet, average water use for toilets would be:

1.6 gpf x 5.04 flushes per person per day = 8.1 gallons per person per day

This process is repeated for all water uses within the home (Table D-3).

Table D-3 Current and Efficient SFR Per Capita Water Demand

End-Use	2004 Water Demand (gpcd)	Efficient Demand (gpcd)
Toilet	17.8	8.1
Shower/Bath	11.0	9.7
Faucet	8.8	8.8
Leak	11.4	1.6
Dishwasher	0.8	0.5
Clothes washer	12.8	7.7
Other Domestic	2.3	2.3
Total	65.0	38.7

We then multiply the number of single-family residential customers within the SNWA service area by the current and efficient per capita indoor demand estimates to obtain the estimate current and efficient indoor demand, respectively (Table D-4):

Current SFR Indoor Per Capita Demand X SFR population = Current SFR Indoor Demand

and

Efficient SFR Indoor Per Capita Demand X SFR Population = Efficient SFR Indoor Demand

The difference between these estimates, 31 KAFY, represents the current SFR indoor conservation potential.

Table D-4 Current (2004) Indoor SFR Conservation Potential

End Use	2004 Water Demand (KAFY)	Efficient Water Demand (KAFY)	Potential Savings	
			KAFY	%
Toilets	21	10	12	55%
Leaks	14	2	12	86%
Clothes Washers	15	9	6	40%
Showers/Bath	13	12	2	12%
Dishwashers	1	0.6	0.4	38%
Other Domestic	3	3	0	0%
Faucets	11	11	0	0%
Total	**78**	**46**	**31**	**40%**

Note: Annual water demand for 2004 and efficient demand were calculated by multiplying per capita water demand estimates in Table D-3 by the estimated SFR population in the SNWA service area. Total may not add up precisely due to rounding.

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