
MEMORANDUM

To: **Sen. Neil Kedzie, Chair, Wisconsin Legislative Council Special Committee on the Great Lakes Water Resources Compact, John Stolzenberg, Chief of Research Services, Wisconsin Legislative Council, and Members of the Special Committee on Great Lakes Water Resources Compact**

From: Jodi Habush Sinykin, Of Counsel, Midwest Environmental Advocates (MEA)

Re: **A Conservation Toolkit for Wisconsin: A Summary of MEA's *Protecting Wisconsin's Water* Report with Appendixes of National Conservation Models**

Date: November 7, 2006

While complete copies of *Protecting Wisconsin's Water: A Conservation Report and Toolkit* will be distributed at the November 13th meeting, given the report's length, I thought it would be useful to provide Committee members with a synopsis of the report's findings and recommendations, as they complement the other submissions regarding conservation and thus should help inform the day's discussion of conservation.

A CONSERVATION TOOLKIT FOR WISCONSIN

Compared to other states in the United States, Wisconsin is water rich. However, some areas of Wisconsin are facing challenges to their water supplies, including drawdown of groundwater aquifers and problems with water quality. In other communities, water demands are quickly exceeding available supplies. In order to ensure that water supplies continue to meet ever increasing water demands, Wisconsin must act to conserve and protect its waters.

The Great Lakes Water Resources Compact provides a valuable opportunity to bring water conservation to the forefront in Wisconsin. The Compact provides:

> Within 2 years of the effective date of this compact, each party shall develop its own water conservation and efficiency goals and objectives consistent with the basin-wide goals and objectives and shall develop and implement a water conservation and efficiency program, ether voluntary or mandatory, within its jurisdiction based on the party's goals and objectives.

The Compact further provides that communities seeking diversions of Great Lakes water must meet the Exception Standard, which, in addition to other criteria, requires the applicant to demonstrate that the proposed diversion will incorporate "environmentally sound and economically feasible" water conservation measures in order to minimize water withdrawals or consumptive use. These conservation measures include methods, technologies or practices for efficient water use that:

a. reflect best practices applicable to the water use sector;
b. are technically feasible and available;
c. are economically feasible and cost effective based on an analysis that considers direct and avoided economic and environmental costs; and
d. consider the particular facilities and processes involved, taking into account the environmental impact, age of equipment and facilities involved, the processes employed, energy impacts and other appropriate factors.

As one more impetus for conservation, the Compact also requires applicants for diversions to demonstrate under the Exception Standard "that there is no feasible, cost effective, and environmentally sound water supply alternative within the Great Lake watershed to which the water will be transferred***, including conservation of existing supplies."***

As such, in keeping with the Compact's conservation ethic, Wisconsin state and community policy makers will need to work toward the development of a water conservation program that:

I. **Requires measurable conservation goals that can be monitored and evaluated**:

State policymakers should be sure to require measurable water conservation goals and objectives that can be monitored and evaluated on an annual basis. In places where this has occurred, the water savings are also fiscal savings, and in places where this has been ignored, conservation has made little progress.

II. **Requires conservation as a condition precedent to a diversion application**

Only by requiring communities to implement conservation measures and programs demonstrating measurable savings prior to their application can Wisconsin be assured that the Compact's conservation goals will be realized by the state. As stated above, the Compact requires applicants for an excepted diversion subject to the Exception Standard to implement conservation measures. It follows that all applications for diversions should be evaluated on the *effectiveness* and the *extent* of the water conservation measures implemented prior to the date of application.

III. **Requires conservation for large water users and eliminates opt out**:

Some states, such as Wisconsin, are silent on the subject of requiring all water users within a municipal water system's boundaries to hook up to the system. This opens the door for large water users to opt out of a municipal water system and seek its own water supply to avoid water conservation requirements. This scenario would result in a smaller pool of utility customers for the same fixed operating costs, thereby creating fiscal difficulties for the municipal water utility. To counter this and promote conservation, the state's conservation program should consider prohibiting large water users not already implementing a conservation program at par with the available municipal utility's from opting out of the municipal water supply.

IV. **Identifies best available technologies and management practices**:

Conservation plans are typically comprised of a variety of best management practices, which entail conservation measures or incentives that have proven to be cost-effective and water efficient. Choosing the best management practices to form the backbone of a successful conservation plan is a task that may seem daunting for policy-makers given the wide variety of conservation measures and incentives from which to choose. To inform discussion and assist those involved in water conservation, this report provides a sample conservation toolkit containing twelve best management practices.

As the following discussion will illustrate, there is no such thing as a one-size-fits-all conservation plan. Communities need to tailor their conservation plans to their own population's needs, norms and values. That said, certain best management practices tend to lend themselves more readily to local and statewide initiatives in Wisconsin.

Outlined below is the three-step process used to develop our toolkit. Step one discusses the need to create water-use profiles. It examines water use in Wisconsin, using Waukesha County as an example, to gain a better understanding of how this information can help inform the selection of best management practices. Step two explores various best management practices and water conservation programs currently implemented in other states – programs that can be used as models for water conservation in Wisconsin. Step three involves selection among these best management practices.

A. Step One: Developing a Water-Use Profile

An important first step in developing a successful conservation program at the local and state level is to develop a water-use profile. A water-use profile should ultimately serve two main functions: first, it should provide a realistic sense of a community's water supply and future water needs; and, second, it should detail where, when and how water is being used. Understanding both the historic and projected water supplies and demands can help communities develop water budgets and set realistic conservation goals to help balance these budgets. Likewise, understanding how water is being used, and in what quantities, can help decision-makers select conservation measures and incentives that will prove most effective.

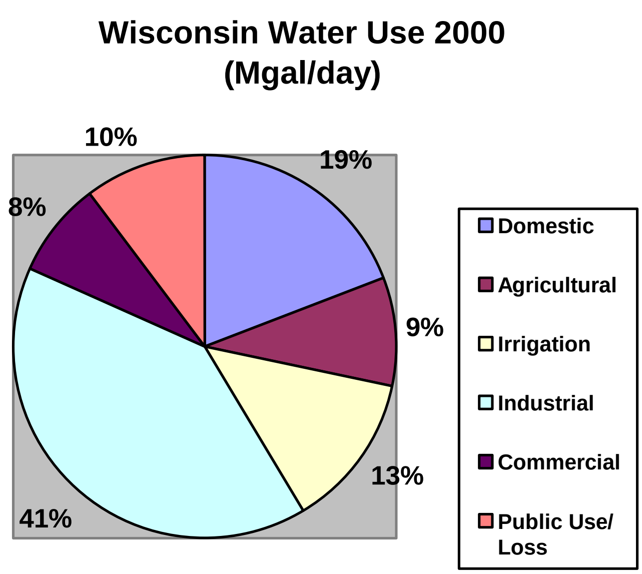
Our goal is to assist Wisconsin policymakers and stakeholders with the development of a successful conservation program with measurable results. As such, the discussion below focuses on the second objective of water-use profiles, understanding water use patterns, by examining water use in Wisconsin and Waukesha County.

In 2000, Wisconsin residents withdrew approximately 7,594 million gallons of water a day from surface and groundwater sources.[1] Of this amount, 79% (6,094 million gallons) was withdrawn almost exclusively from surface waters for use in thermoelectric power production.[2] According to the U.S. Geological Survey, withdrawals for thermoelectric use in Wisconsin in 2000 constituted over 4 times the amount of water withdrawn for all other uses combined.[3]

The majority of water used for thermoelectric power generation is for cooling purposes. In Wisconsin, approximately 99% of this water is returned to the natural system, ultimately becoming available for other uses.[4] However, even consumptive use as low as 1% of total withdrawals can lead to staggering water use numbers when large volumes of water are involved.[5] As such, conservation measures targeting thermoelectric uses will be discussed later in this report.

It is noteworthy, that over 65% of Wisconsin's 72 counties, including Waukesha County, did not withdraw any surface or groundwater in 2000 for thermoelectric purposes.[6] Further, thermoelectric water withdrawals in two counties, Milwaukee and Manitowoc, comprised over 50% of the state's total water withdrawals for use in thermoelectric power production in 2000.[7] As such, and for ease in comparing water use figures statewide to those in Waukesha County, the following water use diagrams and ensuing discussion exclude thermoelectric water withdrawals.

According to the most recent national water use data released by the U.S. Geological Survey, water use in Wisconsin, excluding thermoelectric power use,[8] broke down as follows:[9]



To put things into perspective, estimates indicate that residents of Southeastern Wisconsin withdrew approximately 100 gallons of water per person per day from groundwater sources in 2000.[10]

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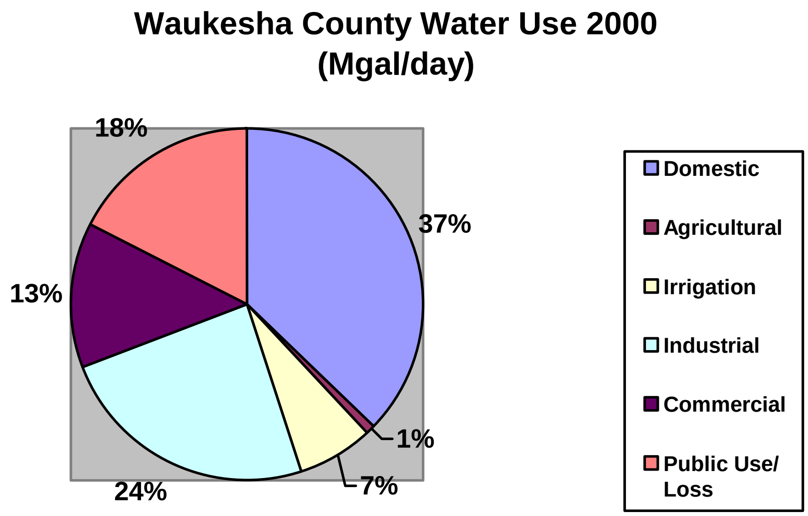
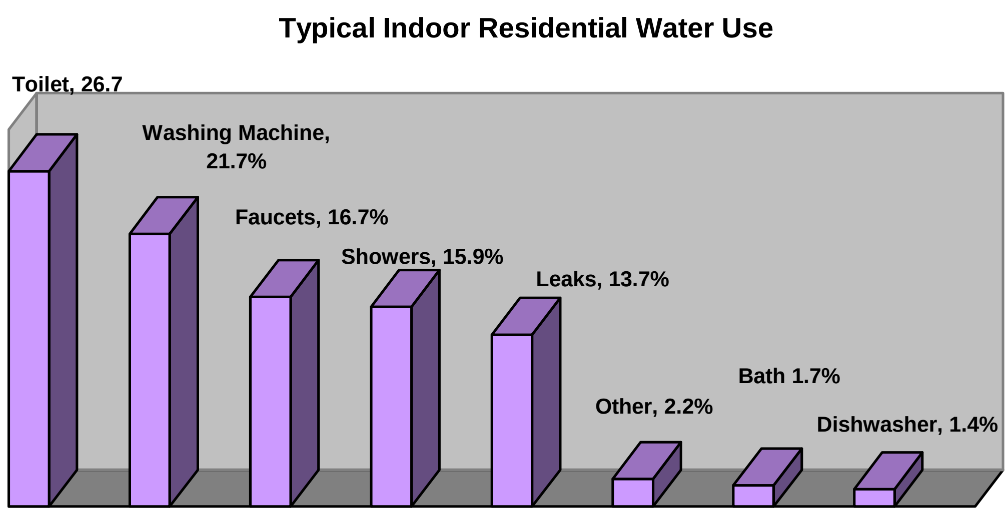
The above water use figures suggest that considerable statewide water savings may be realized by targeting industrial and domestic users and by focusing on irrigation practices. It is important to recognize, however, that the largest categories of water consumption at the state level may vary from the largest water users at the local level. For example, as the use figures for Waukesha County in 2000 indicate, domestic water use comprised the largest water use group in the county followed by industry and public use and losses.[11]



National figures indicate that 69% of residential water use occurs indoors with the remaining 31% being used outdoors.[12] However, given Wisconsin's shorter and cooler summers, it is likely that indoor use in the state comprises an even higher percentage of total domestic water use than the national average. Water use in the home typically breaks down as indicated below.[13]



The above suggests that conservation measures aimed at reducing residential water use, particularly in the bathroom, which accounts for more than half of all indoor water use, have the potential to lead to considerable savings.

Domestic water savings can also be realized through water conservation programs targeting residential outdoor use. Most outdoor water use occurs in the summer months and the increases in water use during this concentrated period of time can place a seasonal strain on utility supplies.

Further, industrial water use accounted for a large portion of water use in Wisconsin and Waukesha County – 41% and 24%, respectively. Industrial use was the single largest use category in Wisconsin and the second largest use category in Waukesha County. Commercial use constituted 8% and 13%, respectively, of all water use in Wisconsin and Waukesha County in 2000 – comprising the fourth largest use category in Waukesha County and the lowest (sixth) use category in Wisconsin.[14]

When examining water use by user category, it is noteworthy that industrial and commercial customers account for significantly greater water usage per site as compared to residential customers. As a result, greater water savings are often realized on a per customer basis when targeting these customers as opposed to residential customers.[15] Additionally, unlike residential use, which is fairly consistent, commercial and industrial use typically varies widely among customers. This suggests that when implementing conservation measures targeting industrial and commercial users, significant initial results can be achieved by focusing on the highest water users in each of these use categories.[16]

Water use for irrigation purposes comprised 13% and 7% of total water use in Wisconsin and Waukesha County, respectively. While these figures are relatively low, it is important to note that Portage, Adams and Waushara Counties reported the highest water uses for irrigation purposes in the state in 2000 and collectively comprised over half of the daily water use for irrigation purposes statewide.[17] Irrigation based conservation initiatives targeting these three counties will likely yield considerable results.

Finally, water use for public uses and losses is worth noting. The public use and loss category refers to uses not specifically categorized, such as water use in some public parks, schools, buildings, water used for fire control, main flushing and water lost from broken water mains and from transfer and distribution systems.[18] In examining ways in which to reduce water consumption in this category, it is important to examine the percentage of unaccounted for losses in water systems. Unaccounted for losses can vary from a small percentage to over 70% of a system's total water pumpage.[19] Water utilities reporting high unaccounted for losses can save considerable amounts of water by instituting leak detection and repair programs. The City of Waukesha Water Utility currently has a low unaccounted for loss figure, reporting unaccounted for losses of 6% in 2004.[20]

B. Step Two: Identifying, Evaluating and Assessing Conservation Measures and Incentives

Once decision-makers understand their community's water use profile and develop conservation goals that set out the numeric water use reduction for which they are aiming, the next step in developing a conservation program is to identify, evaluate and assess the existing myriad of conservation measures and incentives. Conservation measures come in many different forms and vary considerably in cost and ease of implementation. A compilation of national examples of water conservation measures and incentives can found at Appendix A of this Report.

Water demand is inconsistent – it can, and often does, vary dramatically throughout any given twenty-four hour period and from one season to the next. As a result, water distribution systems are designed to accommodate peak demand. It is estimated that water treatment plants and storage facilities are often built as much as four times larger than the average daily demand on the system in order to accommodate these peak periods.[21] During peak periods, which often occur in the summer months, water systems may not be able to maintain adequate water pressure for basic drinking and residential functions, provide water to tall buildings, or provide water to fight fires.[22] Reducing peak water demands can help reduce pressure on water systems and defer capital expenditures for expensive plant expansions. Thus, in addition to reducing overall water demand, comprehensive conservation plans should also aim to reduce peak usage, for example, through selection of best-management practices that seek the reduction of outdoor water use in the summer months.

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1. *Traditional Best Management Practices for Water Conservation*

Traditional and commonly accepted methods of water conservation focus on best management practices that aim to reduce human consumption and water demand. A list of various best management practices implemented in other communities can be found in Appendix A. These best management practices typically take two forms – conservation measures and conservation incentives. Conservation measures are discussed in detail below and can be further characterized as hardware/technical measures or behavioral measures. Incentives address how to motivate people to implement a particular conservation measure and are typically educational, financial or regulatory.[23]

Examples of various conservation incentives include:[24]

Educational	Financial	Regulatory
• School Curriculum • Bill Inserts • TV & Radio Ads • Demonstrations • Training Programs • Conservation Checkli[s]	• Rebates • Conservation Rate Structures • Incentive / Surcharge Fees • Bill Credits • Metering	• Water-Efficiency Ordinances • Laws and Plumbing Codes for Water Efficient Fixtures/ Appliances • Landscape Standards • Irrigation Scheduling • Penalties for Outdoor Water Waste

a. Public Education

It is important to note that public education is an essential element to any conservation program. Public education is often not part of discussions of water conservation measures for two reasons: first, it is virtually impossible to quantify resulting water savings and, second, there are hundreds of different educational tools available. One of the main obstacles to implementing water conservation programs, however, is public perception that water is plentiful.

A recent survey conducted by the Great Lakes Commission on current water conservation practices of the Great Lakes – St. Lawrence Region found that the majority of municipal water supply facilities that do not have formal conservation plans in place cited perception of adequate water supply as the reason.[25] Public education can begin to alter behavioral patterns and can help residents understand the extent and limits of the area's water resources. Armed with this knowledge, the public can and may press policymakers to enact and to implement more stringent regulations to protect one of Wisconsin's most valuable resources.

b. Reducing Residential Water Use

Significant water savings can be realized by targeting residential water use. Some of the most common conservation measures used in the home include replacing water guzzling toilets, faucets and showerheads with low-volume counterparts or through the installation of retrofit devices. Unlike behavioral measures that require continual reinforcement, technical measures produce water savings long after they are initiated and only require a one-time commitment on the part of consumers. Other technical measures include faucet, toilet and shower leak detection and repair and replacing dishwashers and washing machines with more water efficient models. A list of the above-mentioned residential and domestic water efficiency hardware measures and the potential water savings they can achieve are located in Appendix C to this report. Behavioral water efficiency measures are also important and can include turning off faucets when they are not in use and when brushing teeth and shaving, washing only full loads of laundry and dishes, taking shorter showers and refraining from using the toilet as a trash can.[26]

Water savings can also be realized through water conservation programs targeting residential outdoor use. As discussed earlier, due to the seasonal nature of outdoor water use, reductions in this area can significantly impact peak water usage. Frequent sources of outdoor water waste include poor irrigation practices – watering too much and for too long, watering pavement areas, and the use of inefficient equipment.

c. Reducing Industrial Water Use

As discussed above, conservation practices targeting Industrial, Commercial and Institutional ("ICI") water use can lead to considerable water savings per targeted ICI customer. While residential customers typically use water in similar ways, ICI Customers use water for vastly different purposes – manufacturing, running a hospital or health care facility, schools and restaurants. Conservation measures that produce results in one facility may have a minimal impact in others. On-site water audits can provide the most accurate assessment of water efficiency in any given facility and can produce custom tailored water conservation strategies. [27] In addition to these water audits, or where individualized water audits are not practical, conservation rate structures can also help reduce water consumption among ICI Customers, including peak water usage.

A 2000 study of ICI water use and conservation indicates that potential water savings from ICI conservation measures range from 15% to 50%, with 15% to 35% being typical.[28] Amounts spent on ICI conservation plans are typically recouped by ICI customers, through reductions in water and energy costs, between one to four years, with most paybacks occurring in less than 2.5 years.[29]

d. **Reducing Agricultural Water Use**

In the agricultural realm, inefficient irrigation technology and practices are major sources of water waste. There are three basic types of irrigation systems in use throughout the country: surface (gravity) irrigation, sprinkler irrigation and micro-irrigation.[30] According to the U.S. Geological Survey, all irrigation reported in Wisconsin in 2000 was of the "spray" type.[31] The efficiency of spray irrigation systems varies considerably and falls in the range of 60 to 98%**.**[32] Inefficient uses of water also result from evaporation and wind drift caused by water being applied at great heights, non-uniform application of water and malfunctioning systems.[33]

Examples of agricultural related water efficiency measures include the use of low energy precision application or drip irrigation systems, the recovery and reuse of tailwater, the lining of canals and behavioral measures such as altering irrigation patterns based on weather conditions and monitoring soil moisture.[34] As was true with ICI customers, irrigation and agricultural water use practices differ among customers. Water audits conducted on-site can help agricultural customers understand how their water is being used and help customers develop site-specific water conservation practices.

C. Step Three: Selecting Conservation Measures and Incentives

Based on the above analysis of water use patterns and a review of various conservation programs in effect in other communities, we have assembled a Wisconsin Toolkit, comprised of twelve best management practices for state policy makers to consider when developing comprehensive water conservation programs of their own.

A SAMPLE WISCONSIN CONSERVATION TOOLKIT

1. School and Public Information Programs
2. Residential Low-Flow Toilet and Appliance Replacement and Retrofitting programs and Incentives
3. Landscape Conservation Programs and Incentives for Residential and IC I Customers
4. ICI Customer On-Site Audit Programs and Informational Programs and Incentives
5. Implementation of a Conservation Rate Structure Where Appropriate
6. Promotion of Efficient Irrigation Practices and Technologies Among Residenti ICI and Agricultural Customers
7. Water Facility Leak Detection and Repair to Achieve Reductions in Unaccounted-for-flows
8. Land Use Planning Protective of Groundwater Resources
9. Developing Groundwater Recharge / Infiltration Systems
10. Increased Use of Reclaimed Water in Lieu of Other Water Sources – Especiall for Irrigation
11. Leading by Example: Water Efficient Technologies and Practices in Public Parks and Buildings.

Summary

Developing a successful conservation program is a complex task, but a necessary one, both in keeping with the Compact's conservation provisions and in consideration of the needs of Wisconsin's growing economy and population. The preceding analysis of Wisconsin water use patterns and review of best management practices adopted in other areas of the country indicates that certain conservation practices and incentives readily lend themselves to local and state-wide initiatives in Wisconsin. These measures comprise our Conservation Toolkit, a toolkit we hope will be used by state and local policymakers to develop and implement comprehensive water conservation programs for Wisconsin.

APPENDIX A
EXAMPLES OF WATER CONSERVATION MEASURES AND INCENTIVES[35]

Conservation Measure or Incentive	Examples of Communities Implementing Measure or Incentive
I. SCHOOL & PUBLIC INFORMATIONAL PROGRAMS	
Public Informational (including bill inserts, ads, demonstrations, and publications)	The **Town of Cary, NC** has extensive informational programs in place, including its "Beat the Peak" program which encourages summer water conservation through the use of bill inserts, mailings, newspaper, radio and television advertisements and its "Block Leader" program focusing on indoor and outdoor residential water use. **Phoenix, AZ,** in cooperation with Mesa, Scottsdale and the Arizona Department of Water Conservation, launched the "Water Use It Wisely" water conservation campaign in 2000. It has since expanded into a multi-million dollar campaign with over 250 public and private water companies participating nationwide. The city's conservation programs emphasize public education and awareness and include workshops, public events, literature distributions, and information on efficient appliances. **Houston, TX** conducts a number of outreach activities including providing speakers to local businesses and homeowner's associations, attending trade shows, sponsoring an annual water festival, publishing a quarterly newsletter and preparing and distributing water bill inserts. **Tampa, FL** provides a number of downloadable brochures on its website on topics such as "How to Read Your Water Meter," "Conservation Education Program," "Saving Water Indoors," "Save

	Water; Fix Leaks" and "Saving Water Outdoors."
School Education Programs	**The Town of Cary, NC** has staff members available to teach elementary and middle school lessons on water conservation and related topics and to arrange tours of water and wastewater treatment plants. **Phoenix, AZ** has several school education programs in place, including water conservation education for grades K-12 and Project WET (Water Education for Teachers). **Houston, TX** has initiated several student and teacher education initiatives, including providing speakers for elementary schools, its "WET in the City" water education program for teachers and a "Team WET Schools" program whereby students, educators and administrators make a commitment to increasing environmental education and stewardship in their communities. **Tampa, FL** has several in-school education efforts in place, including an elementary school program (K-5), a middle school program (6-8), a high school program (9-12) and a teacher's program, to teach students, teachers and parents about the importance of water resources and conservation.
II. RESIDENTIAL LOW-FLOW TOILET & APPLIANCE REPLACEMENT & RETROFITTING PROGRAMS AND INCENTIVES	
Water Audits	**The City of Ashland, OR** conducts home or business audits to determine the efficiency of plumbing fixtures, and provides replacement showerheads, faucet aerators and toilet retrofits if needed. Information is also provided on appliance rebates and state tax credits.

<table>
<tr><td></td><td>The City of Albuquerque, NM offers free residential indoor/outdoor water audits which include the installation of low-flow shower-heads, aerators and shut off hose nozzles. The city also offers ICI Audits for both large and small account holders.</td></tr>
<tr><td>Consumer rebates and other financial incentives</td><td>The City of Albuquerque, NM offers a number of water conservation incentive programs, many taking the form of water bill credits. Residential incentives include the following:
Toilet rebates: Residential customers can receive a $125 credit for the first toilet replaced, $75 for the second and $50 for the third. Commercial customers are eligible for credits of $90 per toilet.
Dishwasher rebates: $50 rebates.
Washing machine rebates: $100 water bill credit.
The City of Ashland, OR offers toilet rebates to customers who replace existing toilets (3.5 gallons or greater) with ultra-low flush toilets; $45 for the first toilet, $35 for the second and $25 for the third.

El Paso, TX offers a number of water conservation incentive programs to customers of El Paso Water Utilities. Residential incentives include the following:
Ultra low-flow toilet rebates: 75% of purchase price up to $100.
Washing machine rebates: $200 residential / $300 commercial.
The Metropolitan Water District of Southern California, through its Residential Rebate Program, provides rebates for low-flush and dual-flush toilets and clothes washers.</td></tr>
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Use of low-flow plumbing fixtures	**Houston, TX** distributes more than 20,000 "water saver" kits to citizens each year to help them reduce water consumption. The kits contain a displacement bag for the toilet tank, dye tablets for testing leaks, a tankee clipper, a flow restrictor and an instruction manual. Kits are also provided to apartment complex owners and managers. **Tampa, FL** provides free plumbing retrofit kits which include showerheads, bathroom and kitchen aerators and dye tablets for leak detection.
III. LANDSCAPE CONSERVATION PROGRAMS AND INCENTIVES FOR RESIDENTIAL AND ICI CUSTOMERS	
Promotion of the use of native and drought-tolerant turf and plants	**The City of Albuquerque, NM** offers free xeriscape design templates. **The Town of Cary, NC** offers free workshops on landscape planning, drought tolerant plants, and soil improvement and preparation and has a large volume of information on its website. **Tampa, FL** provides free Xeriscape packets.
Consumer rebates and other financial incentives	**The City of Albuquerque, NM** offers a number of water conservation incentive programs, many taking the form of water bill credits. Landscape incentives include the following: • Landscape rebates: Credits are given for the removal of high water use landscapes if 50% of the project area is covered by low water use plants as they will appear at maturity. Spray irrigation is not permitted in rebate areas. Single family residential and multi-family and non-residential customers can earn a credit of $0.40 for every square foot of qualifying landscape if a minimum of 500

	square feet are converted, up to a maximum of $800 residential and $5,000 non-residential. • Multi-setting sprinkler timer rebates - $10 rebates are offered for the purchase of these devices. • Rainwater harvesting barrel rebates: $25 water bill credit. **El Paso, TX** offers a number of water conservation incentive programs to customers of El Paso Water Utilities including landscape rebates of up to $1.00 per square foot of established grass area that is converted into environmental sensitive and water conserving landscapes. **The Metropolitan Water District of Southern California** has established the City Makeover Program -- a competitive grant program providing funding for new Southern California Heritage landscape in prominent public locations within the utility's service areas.
Landscape Standards	**The City of Albuquerque, NM** requires that at least 80% of plants on newly developed properties be low or medium water use. All city- owned new developments other than parks, golf courses, and housing (which are subject to other restrictions) must use medium and low water use plants on 100% of landscaped areas. Violators may be found guilty of a misdemeanor and punished by a fine not to exceed $500 and/or imprisonment for a period not to exceed 90 days.
IV. PROMOTION OF EFFICIENT IRRIGATION PRACTICES AND TECHNOLOGIES AMONG RESIDENTIAL, ICI AND AGRICULTURAL CUSTOMERS	
	Seattle, WA offers conservation tips for commercial buildings on its website, including information on efficient irrigation practice

Informational	**Tampa, FL** provides sensible sprinkling irrigation evaluations, free rain sensors and rain sensor instructions and a free rain barrel kit. **The Metropolitan Water District of Southern California** offers tips on how to use sprinklers more efficiently. Tools include a "Watering Calculator" that creates a customized water schedule and a weekly watering index to help modify watering schedules in response to weather changes.
Irrigation Scheduling / Water Efficiency Ordinances	**The City of Albuquerque, NM** prohibits sprinkler usage from 10 am to 6 pm from April 1 through September 30. A fee of $20 is assessed on the account holder's water bills for first violations and can be as high as $1000 if previous violations have already occurred. **The City of Cary, NC** has a year round alternate day watering ordinance in place and requires rain sensors set at ¼" on all automatic irrigation systems to override irrigation controllers during times of adequate rainfall. Oral or written notices are given for first time violations. Repeat offenders are charged $100 for the first day, $200 for the second, $300 for the third and $400 for every day thereafter. **El Paso, TX –** customers using water from El Paso Water Utilities must comply with mandatory restrictions on certain water use activities including landscape watering day and time restrictions. Violations can result in a class C misdemeanor with fines ranging from $50 to $500 per citation. **Tampa, FL** restricts irrigation to a maximum of two times a week with no lawn watering to occur between the hours of 8 am and 6 pm. Other restrictions apply to personal vehicle washing, pressure washing

	and outdoor aesthetic uses of water. Restrictions apply to all Tampa Water Department customers and to users of all water sources, including well and surface water located inside Tampa city limits. Violations may result in a fine of up to $500 and a mandatory court appearance.
Penalties for Outdoor Water Waste	**The City of Albuquerque, NM** prohibits water waste as a condition of receiving service from the municipal water utility. Enforcement occurs mostly thought complaints which are then observed and documented. Fines are assessed on water bills and increase from $20 for the first offence to $1000 and the addition of a flow restriction device or $2000 for the ninth violation. **The City of Cary, NC** prohibits over watering landscapes by (1) directly watering impervious surfaces and (2) over watering beyond the soil's saturation point. Oral or written notices are given for first time violations. Repeat offenders are charged $100 for the first day, $200 for the second, $300 for the third and $400 for every day thereafter. **El Paso, TX –** customers using water from El Paso Water Utilities are prohibited from wasting water which is defined as (1) landscape watering on the wrong day, (2) allowing water to flow into public rights of way or storm drains and (3) failure to repair a leak within five working days of detecting it. Violations can result in a class C misdemeanor with fines ranging from $50 to $500 per citation. **Tampa, FL** prohibits all wasteful and unnecessary water use. Violations may result in a fine of up to $500 and a mandatory court appearance.
V. ICI CUSTOMER ON- SITE AUDIT PROGRAMS,	

INFORMATIONAL PROGRAMS AND INCENTIVES	
Water Audits	**Houston, TX** conducts water audits for customers with large irrigation landscapes and/or cooling towers. Customers are trained how to use their systems more efficiently in order to decrease water use and reduce their water bills.
Training Programs and Direct Technical Assistance	**Seattle, WA** as part of its "Water Smart Technical Program" offers its regional and ICI Customers information on end use metering, life-cycle cost analysis, speaking engagements on water conservation, technical information on water efficient technologies, bill analysis, water efficient irrigation information an on-site water audits. **Phoenix, AZ** provides technical assistance to industry, business and government by helping create and monitor water budgets, conducting on site water audits, and assisting in developing water conservation plans. The city also provides technical assistance to city departments.
Consumer rebates and other financial incentives to encourage reduction in water use (including surcharges and bill credits)	**Seattle, WA,** as part of its "Water Smart Technology Program," offers financial assistance for qualified water conservation projects completed by large and small businesses. Assistance has included up to 50% of the project cost for commercial and multi-family irrigation systems, water efficient changes relating to process water, commercial laundry, vehicle washing and other unique water use technologies. These incentives often reduce paybacks from over three years or more to 1-2 years or less. **El Paso, TX** offers a number of water conservation incentive programs to ICI customers of El Paso Water Utilities. These incentives include the following: • Refrigerated Air Conditioning: El Paso Water Utilities and El Paso

	Electric offer a joint rebate of $300 (plus any additional incentives offered by dealers) to customers or builders who replace existing evaporative water cooling systems with central refrigeration units in their existing home or install a unit in their new home. • Hot Water on Demand (HWD) Pilot Program: $100 rebate for the installation of an approved Hot Water on Demand or Hot Circulation Pump System. **The Metropolitan Water District of Southern California** has a number of financial incentives in place targeting ICI Customers: • The Innovative Conservation Program is designed to provide grants to explore the water savings potential and practicality of new water conserving technologies. Special consideration is given to projects promoting water-landscape saving products or technologies. • Save A Buck is an aggressive rebate program tailored for the commercial sector. It includes rebates for the installation of ultra-low flush toilets and urinals ($60), clothes washers ($100+), pressurized waterbrooms ($100+), pre-rinse kitchen sprayers ($50+), cooling tower conductivity controllers ($500+), and X-Ray Film Processor Recirculation Systems ($2000+). • The Industrial Process Improvement Program offers financial assistance to local industries to encourage investment in water-saving process improvements. Incentives include: the lesser of (1) $2.26 per 1,000 gallons of actual water saved for a one year monitoring period, (2) fifty percent of the project's water-related

	process improvements, and (3) a buy down of project costs to reduce the simple pay back period to two years.
VI. IMPLEMENTATION OF CONSERVATION RATE STRUCTURES	
	The City of Cary, NC has implemented multi-tiered increasing block water rates. Residential and single family rates range from $3.28 k/gals to $10.83 k/gals. Non-residential and multi-family residential users are given a water budget based on historical water use and are charged $3.75 k/gals for water used up to the budgeted amount and are charged $11.88 k/gals for water use in excess of this amount. Reduced water rates are available for reclaimed water use. **Seattle, WA** has implemented a three-tier seasonal residential rate structure. During off-peak seasons, residents inside the city limits pay $2.35 per 100 cubic feet of water (748 gallons). Rates rise to $2.88 per 100 cubic feet for the first 1,000 cubic feet used in 60 days from May 16th through September 15th, $3.35 per 100 cubic feet for the next 2,600 cubic feet and $8.55 per 100 cubic feet for over 3,600 cubic feet used in 60 days. Commercial users pay $2.00 per 100 cubic feet used off peak and $3.35 per 100 cubic feet from May 16 through September 15 in addition to a set per month base service charge that can range from $6.90 to $1,668 depending on meter size. **Houston, TX** revised its model contract for industrial and municipal users in 1994. Customers whose consumption exceeds their normal average 30- day billing period by more than 10% are charged a 5% penalty. Contract customers are required to prepare conservation plans.

	Tampa, FL has implemented an increasing block rate structure. Residential rates are based on a five-tier system with prices per 100 cubic feet ranging from $1.04 to $3.12 inside the city limits. Commercial rates are based on a four-tier system with prices per 100 cubic feet ranging from $1.20 to $3.12 inside the city limits.
VII. WATER FACILITY LEAK DETECTION AND REPAIR	
	Illinois – all Lake Michigan water users, as a condition to receiving an allocation permit from the Illinois DNR, must reduce unaccounted-for flows to 8% or less based on annual pumpage and implement leak monitoring programs To comply with the Illinois requirement, Chicago has implemented a five-year, $620 million capital improvement program to reduce unaccounted-for flow and water pumpage by replacing 50 miles of leaking water mains each year.
VIII. LEAD BY EXAMPLE – WATER EFFICIENT PRACTICES IN PUBLIC PARKS AND BUILDINGS	
	Seattle, WA has been actively pursuing water conservation measures internally. Seattle currently has 16 city-owned projects participating in the LEED Program (Leadership in Energy & Environmental Design), including the Carkeek Park Environmental Learning Center. Biofiltration swales and infiltration trenches at the center will reduce impact on city water supplies and

	recharge the aquifer. No storm water will drain off site. Rainwater captured from the roof and stored in a cistern and rain barrels will help water plants and flush toilets. These features, along with faucet aerators, low volume and pressure assist toilets will reduce net water use at the center by more than 30%.[36]
IX. REDUCTION OF THERMOELECTRIC WATER USE	
	U.S. Department of Energy – in order to reduce the amount of freshwater used by power plants and to minimize impacts on water quality, the U.S. Department of Energy's National Energy Technology Laboratory has initiated a power plant water research and development program through its Innovations for Existing Plants (IEP) program. The program aims to develop technologies to better manage how power plants use and impact fresh water sources. The project is built around partnerships with industry, academia and other government and non-government organizations. Five research projects are currently being conducted including, "Use of Produced Water in Recirculated Cooling Systems at Power Generation Facilities," "Water Extraction from Coal-Fired Power Plant Flue Gas," and "Environmentally Safe Control of Zebra Mussel Fouling."

APPENDIX B
EXAMPLES OF WATER RECYCLING PROGRAMS[37]

Location of Program	Description
Orange County, CA Orange County Water District ("OCWD")	Orange County's Groundwater Replenishment System ("GWR"), schedul for completion in 2007, will take waste water and purify it to levels simila or better than bottled water. This purified water will be used to replenish the groundwater basin underlying north and central Orange County. Purified water will be pumped to spreading basins and will follow the sam natural filtering path as rainwater and will also be used to expand the seawater intrusion barrier that currently keeps the Pacific Ocean out of the groundwater basin. Once in the groundwater basin, the purified water wil blend with groundwater from the Santa Ana River and imported sources. Upon completion, the GWR will generate enough pure drinking water to meet the needs of 114,000 families, exceed all state and federal drinking water standards and be the largest water purification project of its kind in the world. OCWD currently operates Water Factory 21 which treats reclaimed water This water is then blended with deep well water and pumped into the groundwater basin via a series of 23 multi-point injection wells. The injected water forms a water-mound between the ocean and groundwater basin preventing seawater intrusion. The majority of water injected ultimately augments Orange County's domestic groundwater supply. OCWD also currently owns and operates 1,000 acres of recharge spreadin facilities including 17 major facilities.
El Paso, TX El Paso Water Utilities ("EPWU")	The Fred Hervey Water Reclamation Plant, located in Northeast El Paso, Texas, purifies reclaimed water to drinking water quality levels for reinjection into the Hueco Bolson through a series of injection wells. In 2004, a total of 577 million gallons of reclaimed water was returned to the Hueco Bolson. The plant also supplies approximately 889 million gallons of water to the El Paso Electric Company each year for use in their coolin towers and approximately 187 million gallons of water to a local golf cou for irrigation purposes. Beginning in 2005, the plant will supply 20 millic gallons of water annually to the City of El Paso Regional Park with this number expected to increase to 72 million gallons annually after full implementation of the program. In addition to the Fred Hervey Plant, El Paso Water Utilities has several other water reclamation facilities.
Denver, CO Denver Water	Denver's new recycling plant on the South Platte River in Commerce City came on line April 1, 2004 and is the largest in the state. From start up through the end of the irrigation season in the fall of 2004, approximately

	1,344 million gallons of recycled water were delivered to customers via twelve miles of pipeline. Customers included schools, parks and golf courses. Phase two of the distribution system, which will add a storage reservoir, pump station and six additional miles of pipe is scheduled to be completed by 2007. Future phases will provide recycled water to addition parks and schools, as well as the Denver Zoo, Airport and University. At full capacity, the recycling plant will receive 45 million gallons of water a day from Metro Wastewater's treatment plant.
Gilbert, AZ	Since 1986, the town of Gilbert, Arizona has been using 100% of its reclaimed water. A portion of the reclaimed water is being used to charge the shallow water table through 18 recharge ponds located on over 175 acres at two urban locations and a third site measuring 70 acres. An adde benefit of these recharge areas is the creation of a desert riparian habitat th attracts a variety of wildlife – these riparian areas occur naturally on less than 1% of the land in Arizona but support 60% of the state's wildlife. Reclaimed water is also used by a wide variety of customers for irrigation aesthetic purposes (such as fountains and decorative ponds), and various industrial uses. While there are no current plans to serve individual homeowners, developers of new communities and businesses are responsible for building the infrastructure needed to connect to the town's reclaimed water system.

APPENDIX C

EXAMPLES OF INDOOR RESIDENTIAL AND DOMESTIC WATER EFFICIENCY HARDWARE MEASURES AND POTENTIAL WATER SAVINGS[38]

Low-volume toilets and urinals	• Replacing a 4.5 gallon per flush (*gp*f) toile with a 1.6 *gp*f toilet saves 14,252 gallon per household per year. • Replacing the same toilet in an office building saves 2,262 gallons per female and 754 gallons per male per work-year (260 days • Some toilets use as much as 7.0 *gp*f. • Replacing a 4.5 *gpf* urinal with a 1.0 *gpf* urinal saves an estimated 1,820 gallons of wa per male per work-year.
Low-volume showerheads and showerhead retrofit devices	• Replacing a showerhead with a rated flow 3.0 gallons per minute (*gpm*) with a showerhead with a rated flow of 2.5 *gpm* save an estimated 1,702 gallons of water per household per year.
Low-volume faucets and faucet retrofit devices	• Replacing a faucet with a rated flow of 3.0 *gpm* with a faucet or aerator with a rated flow of 1.5 *gpm* saves an estimated 7,850 gallons p household and an estimated 445 kilowatt-hou of energy per year. • Retrofitting a high volume faucet is often much less expensive than replacing it and usually leads to comparable water savings.
Toilet and urinal retrofit devices	• Water savings from toilet retrofit devices vary depending on device installed and range from 0.5 to 1.5 *gpf* with average household savings of 2 to 4 gallons per capita per day (*gpcd*). • Adjustments to urinal flush valves save an estimated 0.5 *gpf* to 2.0 *gpf*.
Toilet and urinal leak repair	• The average amount of water lost through leakage (mostly from toilets) is 9.5 *gpcd* • A toilet that leaks 5 *gpd* wastes 1,825 gallons of water a year. • It is estimated that 5.5% of homes have leaks averaging more than 100 *gpd.* • Jammed or malfunctioning flush-valve toilets in non-residential facilities can lose

	2,100 gallons of water per hour.
Faucet leak repair	• Water loss from a leaky faucet can range from several gallons to several hundred gallo a day.
Water-efficient dishwashers	• Replacing a dishwasher that uses 9.5-12.0 gallons a load with one that uses 7.0 gpl can save an estimated 361 gallons of water per household per year and save 940 kilowatt hou of energy.
High-efficiency clothes washers	• Replacing a clothes washer that uses 43 gallons per load with a 27 gpl washer saves a estimated 5,705 gallons per household per ye and 615 kilowatts of energy. • Some clothes washers use as much as 56 gallons per load.

Endnotes

[1] ELLEFSON ET AL, *supra* note 111.
[2] *Id.*
[3] *Id.*
[4] *Id.*
[5] According to the authors of a National Renewable Energy Laboratory report on consumptive water use for US power production, "The total amount of water evaporated seems insignificant compared to the total of water passing through the power plant, but when compared to the amount of energy and water consumed in a typical commercial building or residential home, these values are significant." P. TORCELLINI ET AL., NATIONAL RENEWABLE ENERGY LABORATORY, CONSUMPTIVE WATER USE FOR U.S. POWER PRODUCTION, 1 (2003).
[6] ELLEFSON ET AL, *supra* note 111.
[7] *Id.*
[8] ELLEFSON ET AL, *supra* note 111.
[9] *Id.*
[10] This figure is based on an analysis of 2000 pumpage figures reported by various utilities in Southeastern Wisconsin for each well that it operates. Daily per capita water use was obtained by dividing pumpage figures by the population of each community as reported in the 2000 Census. Pumpage figures include water extracted from the aquifer for all purposes including residential, commercial and industrial uses. In cases where the utility does not supply water to an entire community, as is the case, for example, in New Berlin, the per capita consumption calculated (93.0 gallons per capita per day) is artificially low. A more accurate estimate of per capita groundwater use can be made by examining pumpage figures from utilities that supply virtually an entire community, for example, Brookfield/Elm Grove, Cedarburg, and Grafton among others. Daily per capita water consumption in these communities in 2000 was 95.7 gpd, 134.9 gpd and 123.3 gpd, respectively. Email from Dr. Douglas Cherkauer, Professor, University of Wisconsin – Milwaukee, to Donna McGee (Sept. 11, 2005) (on file with Midwest Environmental Advocates).
[11] *Id.*
[12] VICKERS, *supra* note 8, at 12.
[13] P. W. MAYER ET AL., AMERICAN WATER WORKS ASSOCIATION, RESIDENTIAL END USES OF WATER (1999), http://www.h2ouse.net, *see* "Tour / Toilet Water Use" (on file with Midwest Environmental Advocates), *see also* http://www.everydrop.org.
[14] ELLEFSON ET AL, *supra* note 111.
[15] These figures were obtained by taking gallons of water sold by the City of Waukesha Water Utility, as reported in its 2004 Annual Report, to residential, commercial and industrial customers and diving these figures by the average number of residential, commercial and industrial customers, respectively, provided in this same report. WAUKESHA WATER UTILITY, *supra* note 140, at W-2.
[16] VICKERS, *supra* note 8, at 230-231.
[17] ELLEFSON ET AL, *supra* note 111.
[18] *Id.*
[19] OFFICE OF WATER, U.S. ENVTL. PROT. AGENCY, CASES OF WATER CONSERVATION: HOW EFFICIENCY PROGRAMS HELP WATER UTILITIES SAVE WATER AND AVOID COSTS 15 (2002).
[20] WAUKESHA WATER UTILITY, *supra* note 140, at W-16.
[21] MINN. DEP'T OF ENVTL. PROT., REDUCING PEAK DAY DEMANDS CAUSED BY LAWN WATERING (2001), *see* http://www.dnr.state.mn.us/waters (on file with Midwest Environmental Advocates).
[22] VICKERS, *supra* note 8, at 140.
[23] VICKERS, *supra* note 8, at 5-6.
[24] VICKERS, *supra* note 8, at 7.
[25] LAMEKA, *supra* note 6, at 21.
[26] *See* VICKERS, *supra* note 8, at 12-133 (detailed information on residential and domestic water use and efficiency measures can be found in Chapter 2).
[27] VICKERS, *supra* note 8, at 152-153 (for a detailed discussion of landscape water use and efficiency measures, *see* Chapter 3).

[28] Vickers, *supra* note 8, at 235.
[29] *Id.*
[30] VICKERS, *supra* note 8, at 332.
[31] ELLEFSON ET AL, *supra* note 111.
[32] The highest water efficiencies (90-98%) result from a low energy precision application combined with the use of furrow dikes VICKERS, *supra* note 8, at 333, 339.
[33] VICKERS, *supra* note 8, at 332-334.
[34] VICKERS, *supra* note 8, at 6.
[35]The chart is not intended to provide a comprehensive description of each highlighted city's conservation plans, but rather to illustrate the wide variety of conservation measure in place throughout the United States. Many of the below mentioned programs are extensive and multi-faceted and contain measures and incentives not discussed. Contact information and web addresses are provided in Appendix D for each of the listed programs and we encourage readers to learn more about each of the conservation programs highlighted. Unless otherwise noted, the information included in the below chart was found on the websites listed in Appendix D as of May, 2005 and is on file with Midwest Environmental Advocates. For more in-depth descriptions of conservation programs in 17 different communities, *see* OFFICE OF WATER, *supra* note 148. For a brief summary of water conservation incentives (mostly technical/mechanical) in place in 27 cities, *see* OFFICE OF POLICY DEV. AND RESEARCH, U.S. DEPT. OF HOUSING AND URBAN DEV., OVERVIEW OF RETROFIT STRATEGIES: A GUIDE FOR APARTMENT OWNERS AND MANAGERS, APPENDIX B (2002). For case studies of Albuquerque, NM, Southwest Florida Management District, the State of California, the City of Calgary, Alberta, Canada, Fukuoka City, Japan, Western Australia and Israel, *see* LAURA E. KAMINSKI, GREAT LAKES COMMISSION, PUBLIC SECTOR WATER CONSERVATION: TECHNOLOGY AND PRACTICES OUTSIDE THE GREAT LAKES – ST. LAWRENCE REGION (2004).
[36] Information on the City of Seattle's internal conservation programs was found on the website listed in Appendix D as of September 12, 2005 and is on file with Midwest Environmental Advocates.
[37] Information on the programs described was obtained from the various websites indicated in Appendix D as of early May 2005, and is on file with Midwest Environmental Advocates. Contact information for the above mentioned programs can also be found in Appendix D.
[38] Adapted from VICKERS, *supra* note 8, Chapter 1.