Yvonda Price
4/7/2003

Water Conservation

North Texas has the technology and resources to implement the best conservation practices in the state of Texas. The region should implement conservation measures that have been successful in other urban areas. Cities like San Antonio, Austin, El Paso and Houston have all taken conservation very seriously for many years and in doing so have significantly reduced the per capita water usage.

North Texas Regional Water Planning Group has been put in place to develop the North Texas Regional Water Plan for the state of Texas and should consider the following regarding conservation:

1. All of the EPA Water Conservation Plan Guidelines in Appendix A (attached)
2. A conservation pricing structure -that will encourage water reduction for the high end users.
3. Any seller of water should require of its wholesale purchasers either (a) the same specific conservation measures that the seller imposes on its own retail customers, or (b) measures proven to result in greater water savings than those imposed by the seller.

Attached is information on the cost and per capita water savings the other major cities have accomplished through their conservation practices.

Please take all of these into account and if they deem inapplicable, explain the reasons why.

WATER CONSERVATION: INCENTIVE PROGRAMS AND CONSERVATION PRICING

The North Texas region has the potential for significant demand reduction through conservation measures that are more economical than building additional reservoirs. Demand reduction can satisfy our real water *needs* at a much lower cost - in economic, environmental and human terms - than creating new, unnecessary supplies. Before North Texas considers spending more than $1.6 billion on Marvin Nichols Reservoir and inundating 72,000 acres of productive forests and farmlands, the region should implement conservation measures that have been successful in other urban areas, including incentive programs to reduce water use.

The single most effective step that can be taken to conserve water is to **replace old toilets with low-flow models**. This goes beyond writing building codes to require low-flow toilets in new construction and remodeling, and it is most quickly achieved when there is an incentive program in place to cover part or all of the cost of purchase and installation. This concept has been extended to incentive programs to replace old **washing machines** with new high-efficiency models and to programs designed to replace high-water landscapes with **native plants and efficient watering systems**. Cities in Texas and other states have demonstrated that these types of conservation programs, when combined with **conservation pricing structures**, are made cost-effective by the resulting long-term water savings.

Conservation Rates are based on the idea that water demand decreases as prices increase. This has been demonstrated by the experience of Texas cities which have implemented conservation rate structures.[1] In Houston, a resident who puts 25,000 gallons on his lawn will pay $112.47 for the privilege, and an Austin resident will pay $96.60, but a Dallas resident only pays $59.23 for that amount of water.[2]

Environmental Protection Agency[3]:

- Toilets are the greatest water user in the house. Residential 1.6 gallons per flush (gpf) toilets have been shown to reduce toilet water use by 23% to 46% in studies conducted in a number of cities, including Tampa, Phoenix, Austin, and Oakland. High efficiency toilets save an average of 10.5 gallons per person daily.
- Use of high-efficiency toilets and other plumbing products...significantly reduce water demand and wastewater generation over time, which, in turn, can reduce or defer the capital investment needed for water supply and wastewater treatment infrastructure.
- Surveys of thousands of 1.6 gpf toilet customers indicate that the great majority are satisfied with their toilet's performance.

U.S. Bureau of Reclamation[4]:

- Worked with California water agencies to develop Best Practices for water conservation, one of which is residential toilet retrofit programs. An evaluation of its joint effort with the Los Angeles-area water utility said such programs, which accounted for about 63% of funding and 73% of the water savings, "proved to be a very cost-effective program option"

Peter H. Gleick, Pacific Institute for Studies in Development, Environment and Security[5]:

- The Pacific Institute has worked extensively with the State of California on water conservation.[6]
- Key message: "Improving the productive use of existing water resources, through reducing waste and inefficiency, is a relatively fast and inexpensive way to meet new water needs."[7]
- Without any conservation efforts, California toilets would be using 1.2 million acre-feet per year (afy). Toilet replacements required by law have reduced that amount to about 780,000 afy. If everyone in California had a low-flush toilet, about 300,000 afy would be used for toilets.[8]

Examples of Toilet Rebate Programs:

1. **New York City**: New York City invested $393 million in a 1.6 gpf toilet rebate program; reduced water demand and wastewater flow by 90.6 million gallons per day (mgd), 7% of the city's total water consumption. Rebates were $150 - $240 per toilet.[9] The rebate program accomplished a net present value savings of $605 million from a twenty-year deferral of water supply and wastewater treatment expansion projects.[10]
2. **Los Angeles, San Diego and Southern California**: Since 1988, the Metropolitan Water District of Southern California (MWD) has funded rebates for 1.6 million low-flow toilets, for savings in excess of 18 billion gallons of water per year over the 20-year life span of the toilets. Rebates in Los Angeles ranged from $75 - $120 per toilet, and a special program distributed free toilets to low-income residents. Annual savings amount to 48,000 acre-feet at a cost of less than $200 per acre-foot.[11]
3. **Tampa, Florida**: By 1999, Tampa had replaced 15,078 high-volume toilets in 11,551 single-family and multi-family residences. Demonstrated water savings was 38 gallons per day (gpd) per household. This represents a total savings of more than 160 million gallons each year and over 3.2 billion gallons over the 20-year life span of the replacement toilets.[12]
4. **Santa Monica**: Invested $5.4 million in a toilet rebate program and achieved permanent reductions in water usage and wastewater flows of over 1.9 mgd, representing a 15% reduction in average total water demand and a 20% reduction in average total wastewater flow. Result is a net savings of $6 million in the year 2002 alone from avoided costs of water imports and wastewater treatment.[13]
5. **San Antonio**: Offers $75 rebate per toilet replaced and estimates savings of 8,000 – 20,000 gallons per year per toilet.[14]
6. **Austin**: Toilets are provided free of charge with $30 rebate for installation, or homeowners are given up to $100 rebate for purchase of qualifying models. Result is 20% reduction in indoor water use from replacement of toilets alone.[15]
7. **El Paso**: Up to $100 rebate on toilets.[16]
8. **Tempe, AZ**: $75 rebate on toilets.[17]

High-efficiency Washing Machine (HEW) rebate programs are identified by the Bureau of Reclamation as one of its "Best Practices".[18] A May 2001 study reported 28 utilities participating in incentive programs for HEWs. Many programs are aimed at multi-family residences and laundromats.[19] Examples include:

1. **San Diego**: Offers a voucher for $125 for purchase of a HEW ($300 for commercial customers).[20] As of May 2002, 12,000 washers had been purchased, saving 470 acre-feet of water.[21] The city projects savings of 5,075 acre-feet over the life of a washer.[22]
2. **San Antonio**: $200 rebate on HEWs.[23]
3. **El Paso**: $200 rebate on HEWs.[24]
4. **Austin**: $100 rebate on HEWs[25]

5. **Los Angeles**: $150 rebate on HEWs.[26]
6. **Seattle**: $75 rebate on HEWs.[27]

Landscape Incentive Programs are also identified by the Bureau of Reclamation as one of its "Best Practices".[28] Residential landscape rebate programs usually have a list of qualifying plants and are calculated by the amount of area converted. Examples include:

1. **Austin**: Homeowners receive up to $250 for irrigation improvements and up to $500 for planting "water wise" trees and shrubs.[29]
2. **San Antonio**: Pays 10¢ per square foot for planning and installing a watersaver landscape, with a minimum conversion of 1000 square feet ($100), and a maximum rebate of $500 for 5000 square feet (half credit if over 50% of the whole yard is planted in turf).[30]
3. **El Paso**: Turf rebates of $1/sq. ft. resulted in savings of 23 million gallons in 2002.[31]
4. **Albuquerque**: Residential rebates up to $500, commercial rebates up to $700. Minimum qualifying area 500 sq. ft. Sprinkler systems disqualify the area but drip, soaker, bubbler and hand-watering qualify.[32]

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[1] http://www.texaswatermatters.com/conservation_users.htm#1
[2] Based on rates posted on city water utility websites, excluding meter and sewer charges.
[3] http://www.epa.gov/owm/water-efficiency/toilets.htm
[4] http://www.lc.usbr.gov/scao/conserve.htm
[5] http://www.pacinst.org. Gleick is the lead author of *The World's Water The Biennial Report on Freshwater Resources* (Island Press), http://www.pacinst.org/book/.
[6] http://www.pacinst.org/water.html
[7] "Memorandum to the President" by Peter H. Gleick - Global Water: Threats and Challenges Facing the U.S.", http://www.aspeninst.org/eee/pdfs/gliek.pdf
[8] http://www.cnr.berkeley.edu/bwwg/gleick.pdf
[9] The New York city Toilet Rebate Program: Economic Incentives for Water Conservation, http://www.megacitiesproject.org/publications/print.asp
[10] http://www.epa.gov/owm/water-efficiency/toilets.htm
[11] MWD website, http://www.mwd.dst.ca.us/mwdh2o/pages/conserv/program01.html; "Water Efficiency Case Studies from California: The Reservoir that Toilets Built" by Mary Ann Dickinson, California Urban Water Conservation Council, http://www.damsreport.org/docs/kbase/contrib/opt162.pdf; "LADWP Is Flush with Pride" – News Release 11/5/01 from Los Angeles Dep't. of Water and Power, http://www.ladwp.com/whatnew/dwpnews/archive/110501.htm
[12] http://www.tampagov.net/dept_water/conservation_education/pdf/5yr%20Report%20%20CA4-9-28.pdf
[13] http://www.epa.gov/owm/water-efficiency/toilets.htm
[14] San Antonio Water System website, http://www.saws.org/conservation/programs/kickthecan.shtml
[15] Texas Section of the American Water Works Association, http://www.tawwa.org/water_in_texas.htm
[16] http://www.epwu.org/; see also a list of cities which have adopted incentive programs for replacement of toilets, clothes washers and landscaping: www.massaudubon.org/News_&_Action/Rivers/incentives.html
[17] id.
[18] See footnote 2.
[19] www.ece1.org/com/cwsh/01comwsh_progsum.pdf
[20] http://www.sannet.gov/water/conservation/washer.shtml
[21] San Diego Water County Authority News Release 5/23/02, http://www.sdcwa.org/news/052302Award.phtml
[22] Grant proposal by the City of San Diego to the State of California for an incentive program to encourage the installation of HEWs: http://www.dpla.water.ca.gov/grants-loans/urb-psp.html
[23] http://www.saws.org/conservation/programs/washers.shtml
[24] http://www.epwu.org/
[25] http://www.ci.austin.tx.us/watercon/stwasher.htm
[26] http://www.ladwp.com/water/conserv/washers/index.htm.
[27] http://www.ci.seattle.wa.us/util/RESCONS/washwise/default.htm
[28] See footnote 2.
[29] http://www.ci.austin.tx.us/watercon/waterwiseland.htm
[30] http://www.saws.org/conservation/outdoor/lawn.shtml
[31] http://www.epwu.org/ "What's New"
[32] http://www.cabq.gov/waterconservation/xeriorebate.html

http://www.epa.gov/owm/water-efficiency/wave0319/append_a.htm **copied 3/3/03**

EPA Water Conservation Plan Guidelines

APPENDIX A
WATER CONSERVATION MEASURES

This Appendix to the EPA Guidelines for Preparing Water Conservation Plans describes the water conservation measures that water utilities can use in designing water conservation programs. As part of their conservation plans, planners should consider, *at a minimum*, each of the measures specified in the Basic, Intermediate, or Advanced Guidelines, depending on which set of Guidelines apply to the water system.

The measures are organized into three general categories: Level 1, Level 2, and Level 3 Within each level are four subcategories that are used to organize a variety of specific conservation measures:

- Level 1 Measures
  - Universal metering
  - Water accounting and loss control
  - Costing and pricing
  - Information and education
- Level 2 Measures
  - Water-use audits
  - Retrofits
  - Pressure management
  - Landscape efficiency
- Level 3 Measures
  - Replacements and promotions
  - Reuse and recycling
  - Water-use regulation
  - Integrated resource management

This system of organizing the conservation measures recognizes that the measures considered can vary with the size and capability of the system. *Water systems are strongly encouraged to explore the fullest range of conservation measures practical, including measures beyond the minimum measures suggested in the Guidelines that they are following.* Many smaller and middle-sized utilities have been very successful in implementing a wide range of beneficial conservation programs.

What follows is a description of each of the twelve subcategories of measures. The Guidelines provide checklists that planners can use in reviewing measures. However, planners are encouraged to consider as many measures as practical given their capability and the conditions they seek to address. In some cases, planners may choose to consider and implement selected measures beyond those minimally recommended for consideration

Although this list of conservation measures is relatively current and comprehensive, planners should not limit their analysis only to the measures mentioned here. Planners also should consider new technologies and approaches as they become available. Letters next to each category indicate whether the measures in that category are considered particularly useful in reducing average-day demand [A], maximum-day or peak demand [P], both [B]. Worksheets for some of the conservation measures are provided at the end of this Appendix.

Level 1 Measures

Universal Metering [B]

Measures	Advanced Guidelines		
	Intermediate Guidelines		
	Basic Guidelines		
Universal metering [B]	Source-water metering	Fixed-, interval meter reading	Test, calibrate, repair, and replace meters
	Service-connection metering and reading	Meter-accuracy analysis	
	Meter public-use water		

Metering is a very fundamental tool of water system management and conservation. Worksheet A-1 can be used by systems to assess their metering practices.

Source-water metering. Both the supplier and the customer benefit from metering. Source metering is essential for water accounting purposes.

Service-connection metering. Service-connection metering is needed to inform customers about how much water they are using; suppliers use metering data to more accurately track water usage and bill customers for their usage.

Public-use water metering. All water provided free of charge for public use should be metered and read at regular intervals. This will allow the utility to more accurately account for water. Lack of metering undermines loss control, costing and pricing, and other conservation measures.

Fixed-interval meter reading. A program of fixed-interval meter reading is essential to determine the amount of nonrevenue-producing water. Source meters and service connection meters should be read at the same relative time in order to facilitate accurate comparisons and analysis. Readings generally should occur at regular intervals, preferably monthly or bimonthly Estimated bills should be kept at a minimum, subject to state and local regulations.

Meter accuracy. Water meters can be damaged and deteriorate with age, thus producing inaccurate readings. Inaccurate readings will give misleading information regarding water usage, make leak detection difficult, and result in lost revenue for the system. All meters, especially older meters, should be tested for accuracy on a regular basis The system also should determine that meters are appropriately sized. Meters that are too large for a customer's level of use will tend to under-register water use

Meter testing, calibration, repair, and replacement. After determining the accuracy of the metering system, the utility should provide a schedule of activities necessary to correct meter deficiencies. Meters should be recalibrated on a regular basis to ensure accurate water accounting and billing.

Water Accounting and Loss Control [A]

Measures	Advanced Guidelines		
	Intermediate Guidelines		
	Basic Guidelines		
Water accounting and loss control [A]	Account for water	Analyze nonaccount water	Loss-prevention program
	Repair known leaks	Water system audit	
		Leak detection and repair strategy	
		Automated sensors/ telemetry	

In many respects, water conservation begins on the supply side. All water systems will benefit from a water accounting system that helps track water throughout the system and identify areas that may need attention, particularly large volumes of nonaccount water. Nonaccount water includes water that is *metered but not billed*, as well as *all unmetered* water. Unmetered water may be authorized for such utility purposes (such as operation and maintenance) and for certain public uses (such as fire hydrant maintenance). Unmetered water also includes unauthorized uses, including losses from accounting errors, malfunctioning distribution system controls, thefts, inaccurate meters, or leaks. Some unauthorized uses may be identifiable. When they are not, these unauthorized uses constitute *unaccounted-for water*.

Implementing a system of water accounting is a necessary first step in developing strategies for loss control. A system of water accounting is provided in Figure A-1. This system for tracking water begins with total water produced and ends with unaccounted-for water. Worksheet A-2 (which follows Figure A-1) and Worksheet A-3 can assist water systems in developing a water accounting and loss control strategy.

Account for water. All water systems, even smaller systems, should implement a basic system of water accounting (as appears in Worksheet A-3). This accounting exercise provides a basis for a strategy to control losses over time.

Repair known leaks. The cost of water leakage can be measured in terms of the operating costs associated with water supply, treatment, and delivery; water lost produces no revenues for the utility. Repairing larger leaks can be costly, but it also can produce substantial savings in water and expenditures over the long run.

Water accounting is less accurate and useful when a system lacks source and connection metering. Although the system should plan to meter sources, unmetered source water can be estimated by multiplying the pumping rate by the time of operation based on electric meter readings.

Analysis of nonaccount water. Nonaccount water use should be analyzed to identify potential revenue-producing opportunities, as well as recoverable losses and leaks. Some utilities might consider charging for water previously given away for public use or stepping up efforts to reduce illegal connections and other forms of theft.

System audit. A system audit can provide information needed to make a more accurate analysis of nonaccount water.

Leak detection and repair strategy. Systems also should institute a comprehensive leak detection and repair strategy. This strategy may include regular on-site testing using computer-assisted leak detection equipment, a sonic leak-detection survey, or another acceptable method for detecting leaks along water distribution mains, valves, services, and meters. Divers can be used to inspect and clean storage tank interiors.

Automated sensors/telemetry. Water systems also consider using remote sensor and telemetry technologies for ongoing monitoring and analysis of source, transmission, and distribution facilities. Remote sensors and monitoring software can alert operators to leaks, fluctuations in pressure, problems with equipment integrity, and other concerns.

Loss-prevention program. This may include pipe inspection, cleaning, lining, and other maintenance efforts to improve the distribution system and prevent leaks and ruptures from occurring. Utilities might also consider methods for minimizing water used in routine water system maintenance procedures in accordance with other applicable standards.

Costing and Pricing [B]

Measures	Advanced Guidelines		
	Intermediate Guidelines		
	Basic Guidelines		
Costing and pricing [B]	Cost-of-service accounting	Cost analysis	Advanced pricing methods
	User charges	Non-promotional rates	
	Metered rates		

Costing and pricing are conservation strategies because they involve understanding the true value of water and conveying information about that value, through prices, to water customers. The use of user charges often is considered a necessary (but not always sufficient) part of a water conservation strategy. Many resources are available on how to account for costs and design water rates.

Cost-of-service accounting. Water systems should use cost-of-service accounting, consistent with generally accepted practices. Many resources are available for this purpose. Understanding and tracking system costs also is a capacity-development strategy for small systems.

User charges. Once costs are established, systems can develop more accurate user charges (or rate structures).

Metered rates. Metered rates should be used so that the customer's water bill corresponds to their water usage. For many systems, change in water rates must be approved by regulators or other oversight bodies. It is important for water systems to communicate with regulators about costs and the need for cost-based pricing.

Cost analysis. Systems should conduct a cost analysis to understand what types of usage drive system costs. For example, systems should analyze patterns of usage by season and class of service.

Nonpromotional rates. Systems also should consider whether their current rate structures promote water usage over conservation; nonpromotional rates should be implemented whenever possible in order to enhance the conservation signal of rates.

Systems seeking to encourage conservation through their rates should consider various issues: the allocation between fixed and variable charges, usage blocks and breakpoints, minimum bills and whether water is provided in the minimum bill, seasonal pricing options, and pricing by customer class.

Systems also should consider the effect of introducing a new rate structure on revenues. Worksheet A-4 is provided for this purpose. Conservation-oriented pricing requires planners to make certain assumptions (based on the available empirical evidence) about the elasticity of water demand, or the responsiveness of water usage to a change in price. Elasticity is measured by the ratio of a percentage change in quantity demanded to a percentage change in price. Changes in the rate structure should allow the system to achieve demand reduction goals recovering water system costs. In allocating costs, the impact of the rate structure on user demand and revenues for specific customer classes should be considered.

Advanced pricing methods. Advanced pricing methods generally allocate costs by customer class and/or type of water use. Advanced pricing might consider seasonal variations or other methods for pricing indoor and outdoor usage based on differing contributions to system peaks. The conservation orientation of the rate structure can be enhanced by considering the elasticity factors for different classes of water use. Marginal-cost pricing, which considers the value of water relative to the cost of the next increment of supply, can be considered as well. Systems also can consider special ratemaking provisions (such as cost-recovery or lost-revenue mechanisms). Potential revenue instability can be addressed with additional rate structure modifications (such as revenue-adjustment mechanisms).

Obviously, the pricing strategy must be consistent with overall system goals and approved by regulatory or other governing bodies.

Information and Education [B]

Measures	Advanced Guidelines		
	Intermediate Guidelines		
	Basic Guidelines		
Information and education [B]	Understandable water bill	Informative water bill	Workshops
	Information available	Water-bill inserts	Advisory committee
		School program	
		Public-education program	

Information and education are critical to the success of any conservation program. Information and education measures can directly produce water savings, as when customers change their water-use habits. These savings can be difficult to estimate. Also, public education alone may not produce the same amount of sustained water savings as other, more direct approaches (such as leak repairs and retrofits).

But educational measures also can enhance the effectiveness of other conservation measures. For example, it is widely believed that information plays a role in how water consumers respond to changes in price. More generally, customers that are informed and involved are more likely to support the water system's conservation planning goals. Worksheet A-5 is provided for systems to use in assessing their information and education programs.

Understandable water bill. Customers should be able to read and understand their water bills. An understandable water bill should identify volume of usage, rates and charges, and other relevant information.

Information available. Water systems should be prepared to provide information pamphlets to customers on request. Public information and education are important components of every water conservation plan. Consumers are often willing to participate in sound water management practices if provided with accurate information. Furthermore, providing information and educating the public may be the key to getting public support for a utility's water conservation efforts. An information and education program should explain to water users all of the costs involved in supplying drinking water and demonstrate how water conservation practices will provide water users with long term savings.

Informative water bill. An informative water bill goes beyond the basic information used to calculate the bill based on usage and rates Comparisons to previous bills and tips on water conservation can help consumers make informed choices about water use

Water bill inserts. Systems can include inserts in their customers' water bills that can provide information on water use and costs Inserts also can be used to disseminate tips for home water conservation

School program. Systems can provide information on water conservation and encourage the use of water conservation practices through a variety of school programs. Contacts through schools can help socialize young people about the value of water and conservation techniques, as well as help systems communicate with parents.

Public education program. Utilities can use a variety of methods to disseminate information and educate the public on water conservation. Outreach methods include speakers' bureaus, operating booths at public events, printed and video materials, and coordination with civic organizations.

Workshops. Utilities can hold workshops for industries that might be able to contribute to water conservation efforts. These might include, for example, workshops for plumbers, plumbing fixture suppliers, and builders or for landscape and irrigation service providers.

Advisory committee. A water conservation advisory committee can involve the public in the conservation process; potential committee members include elected officials, local business people, interested citizens, agency representatives, and representatives of concerned local groups. The committee can provide feedback to the utility concerning its conservation plan and develop new material and ideas about public information and support for conservation in the community. Of course, to be meaningful, the utility must be receptive to ideas offered by the committee.

Level 2 Measures

Water-Use Audits [B]

<table>
<tr><td rowspan="3">Measures</td><td colspan="3">Advanced Guidelines</td></tr>
<tr><td colspan="2">Intermediate Guidelines</td><td></td></tr>
<tr><td>Basic Guidelines</td><td colspan="2"></td></tr>
<tr><td>Water-use audits [B]</td><td></td><td>Audits of large-volume users</td><td>Selective end-use audits</td></tr>
<tr><td></td><td></td><td>Large-landscape audits</td><td></td></tr>
</table>

Water-use or end-use audits can provide water systems and their customers with invaluable information about how water is used and how usage might be reduced through specific conservation strategies

Audits of large-volume users. Utilities can facilitate water audits for large-volume users, both commercial and industrial. Water audits should begin by identifying the categories of water use for the large-volume user. These may include process, sanitary, domestic, heating, cooling, outdoor, and other water uses. Second, a water audit should identify areas in which overall water use efficiency can be improved through alternative technologies or practices.

Large-landscape audits. Water audits can be used for outdoor usage, as well as for indoor processes Audits of irrigation practices can provide large-volume commercial,

industrial, and public users with information about usage and usage-reduction techniques. These audits can be used in conjunction with irrigation submetering and other landscaping efficiency practices.

Selective end-use audits. Water audits can be widened to include selective end-use audits by customer class, focusing on typical water-use practices within each class. An audit program can be selective in terms of targeting customer groups that have particular needs or for which water conservation could be particularly beneficial. Audits targeted to older housing, for example, can be particularly beneficial in terms of identifying and fixing plumbing leaks.

End-use audits also can be tailored to the usage practices within user groups. For example, residential water audits may focus on plumbing fixtures, lawn and garden water practices, and customer behavior. Residential water audits can be used to make immediate repairs and retrofits. Worksheet A-6 summarizes the components of a residential water audit. All water audits should include a written report to the customer that includes specific ideas for conservation. Water audits can be planned and implemented in conjunction with electric power companies or others interested in promoting conservation practices.

Retrofits [A]

<table>
<tr><td rowspan="3">Measures</td><td colspan="3">Advanced Guidelines</td></tr>
<tr><td colspan="2">Intermediate Guidelines</td><td></td></tr>
<tr><td>Basic Guidelines</td><td colspan="2"></td></tr>
<tr><td>Retrofits [A]</td><td></td><td>Retrofit kits available</td><td>Distribution of retrofit kits</td></tr>
<tr><td></td><td></td><td></td><td>Targeted programs</td></tr>
</table>

Water systems can promote conservation through a retrofit program. Retrofitting involves making an improvement to an existing fixture or appliance (versus replacement) in order to increase water-use efficiency. Retrofit programs usually target plumbing fixtures.

Retrofit kits available. A basic retrofit kit may include low-flow faucet aerators, low-flow showerheads, leak detection tablets, and replacement flapper valves. Retrofit kits may be made available free or at cost.

Calculating the savings from a retrofit program requires planners to make a number of assumptions about water use and savings. Some of the assumptions used in retrofitting are:[1]

- Toilets (4-6 flushes per person per day)
- Showerheads (5-15 shower-use minutes per person per day)
- Bathroom Faucets (5-3 faucet-use minutes per person per day)
- Kitchen Faucets (5-5 faucet-use minutes per person per day)

Many useful textbooks and manuals are available to help planners estimate typical water use and potential savings from retrofits (See Appendixes B and D.)

Distribution of retrofit kits. Water systems can actively distribute retrofit kits directly or through community organizations. Retrofit kits also can be distributed in conjunction with audit programs.

Targeted programs. Utilities might institute targeted programs for different customer classes (residential, commercial, industrial, public buildings, and so on). Retrofits of industrial premises can include facilities used by the public and employees, as well as facilities used for production purposes. A program to retrofit low-income housing units may conserve considerable water in older residential housing units with inefficient plumbing fixtures. Targeted programs also could be designed in cooperation with community organizations. An active retrofit program might be part of a residential water-use audit program. It is important that planners ensure that retrofit programs conform to local plumbing codes and ordinances.

Pressure Management [A]

Measures	Basic Guidelines	Intermediate Guidelines	Advanced Guidelines
Pressure management [A]		Systemwide pressure management	Selective use of pressure-reducing valves

Reducing excessive pressures in the distribution system can save a significant quantity of water. Reducing water pressure can decrease leakage, amount of flow through open faucets, and stresses on pipes and joints which may result in leaks. Lower water pressure may also decrease system deterioration, reducing the need for repairs and extending the life of existing facilities. Furthermore, lower pressures can help reduce wear on end-use fixtures and appliances.

Systemwide pressure management. For residential areas, pressures exceeding 80 psi should be assessed for reduction Pressure management and reduction strategies must be consistent with state and local regulations and standards, as well as take into account system conditions and needs. Obviously, reductions in pressure should not compromise the integrity of the water system or service quality for customers.

Pressure-reducing valves. A more aggressive plan may include the purchase and installation of pressure-reducing valves in street mains, as well as individual buildings. Utilities might also insert flow restrictors on services at the meter. Restrictors can be sized to allow for service length, system pressure, and site elevation. Utilities can consider providing technical assistance to customers to address their pressure problems and install pressure-reducing valves to lower the customers' water pressure. This may be especially beneficial for large-use customers.

Landscape Efficiency [P]

Measures	Advanced Guidelines		
	Intermediate Guidelines		
	Basic Guidelines		
Landscape efficiency [P]		Promotion of landscape efficiency	Landscape planning and renovation
		Selective irrigation submetering	Irrigation management

Outdoor water usage drives maximum-day demand, which in turn drives requirements for transmission and treatment facilities. Reducing outdoor usage can thus be a very effective conservation strategy. Outdoor water use can be reduced through efficiency-oriented landscaping principles.

Promotion of landscape efficiency. Utilities can promote the development of water conserving principles into the planning, development and management of new landscape projects such as public parks, building grounds, and golf courses. Utilities can also promote low water-use landscaping by residential and nonresidential customers, especially those with large properties. Utilities can cooperate with local nurseries to ensure the availability of water conserving plants.

Water systems may promote Xeriscaping™, an efficiency-oriented approach to landscaping that encompasses seven essential principles:

- Planning and design
- Limited turf areas
- Efficient irrigation
- Soil improvement
- Mulching
- Use of lower water demand plants
- Appropriate maintenance

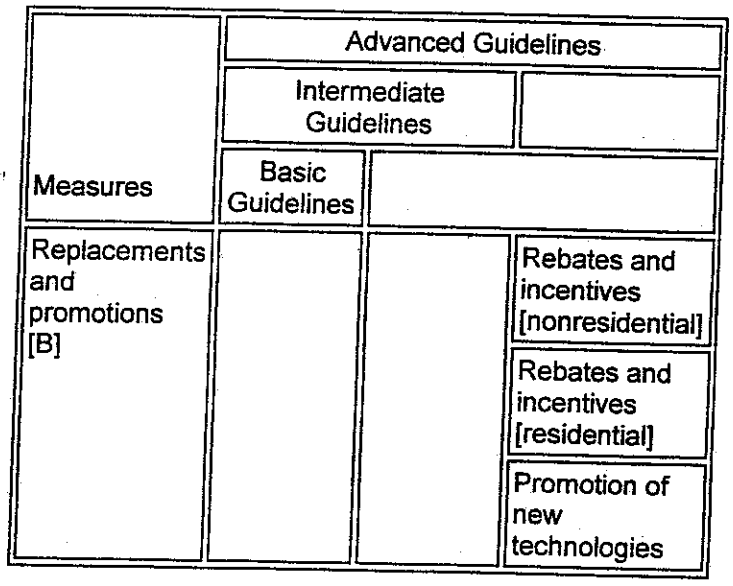
Selective irrigation submetering. Selective submetering for irrigation water can be used to improve irrigation management, as well as to introduce irrigation pricing.

Landscape planning and renovation. Existing landscapes can be renovated to incorporate water-conserving practices. Public parks, for example, could be managed to incorporate water-efficient landscaping and reduce or eliminate irrigation. Utilities can work with commercial and industrial customers to plan and renovate landscaping in accordance with water conserving practices.

Irrigation management. Irrigation management systems, using metering, timing, and water-sensing devices, also can be promoted by the water utility for large-volume customers.

Level 3 Measures

Replacements and Promotions [B]



Rebates and incentives. In order to accelerate the replacements of older fixtures, utilities can offer rebates and other incentives. Utilities can install water-efficient fixtures by providing fixtures at no cost, giving a rebate for consumer purchased fixtures, or arranging suppliers to provide fixtures at a reduced price. Utilities can design incentive rebate programs that are targeted to the nonresidential and residential sectors, and to indoor and outdoor uses.

The feasibility and effectiveness of replacements may depend on state and local plumbing codes. A program to accelerate replacements, coupled with high-efficiency standards, can yield substantial water savings.

Promotion of new technologies. Utilities also can get involved with promoting new technologies by manufacturers and distributors of fixtures and appliances. Demonstrations and pilot programs, and even contests, can be used to introduce and promote new products (such as high-efficiency washing machines).

Reuse and Recycling [B]

Measures	Advanced Guidelines	Intermediate Guidelines	Basic Guidelines	
Reuse and recycling [B]				Industrial applications
				Large-volume irrigation applications
				Selective residential applications

Industrial applications. An alternative water source for some systems is "graywater," or treated wastewater for nonpotable water uses. Water reuse and recycling practices reduce production demands on the water system. Water utilities should work with their nonresidential customers to identify potential areas for reuse or recycling. Some industries can substantially reduce water demand through water reuse (or multiple use) in manufacturing processes. Recycled wastewater can be used for some industrial purposes, agricultural purposes, groundwater recharge, and direct reuse.

Large-volume irrigation applications. Reuse and recycling can be encouraged for large-volume irrigation.

Selective residential applications. In some areas, reuse and recycling can be used in residential applications. Water systems will need to check with local plumbing codes and ordinances for possible conditions and restrictions.

Water-Use Regulation [B]

Measures	Advanced Guidelines	Intermediate Guidelines	Basic Guidelines	
Water-use regulation [B]				Water-use standards and regulations
				Requirements for new developments

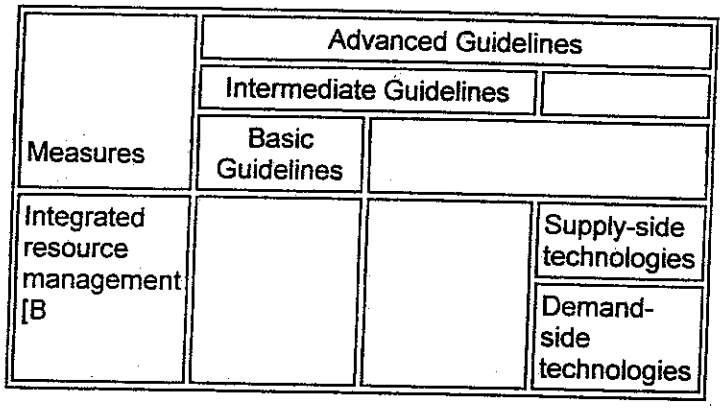
Water-use standards and regulations. Regulations should be in place to manage water use during droughts or other water-supply emergencies. In some cases, utilities may find it desirable to extend water-use regulations to promote conservation during nonemergency situations. Examples of water-use regulations are:

- Restrictions on nonessential uses, such as lawn watering, car washing, filling swimming pools, washing sidewalks, and irrigating golf courses.
- Restrictions on commercial car washes, nurseries, hotels, and restaurants.
- Standards for water-using fixtures and appliances (in addition to the federal efficiency standards, which can be found at the end of this Appendix).
- Bans or restrictions on once-through cooling.
- Bans on non-recirculating car washes, laundries, and decorative fountains.
- Bans on certain types of water use or practice.

Requirements for new developments. Another type of regulation is to impose standards on new developments with regard to landscaping, drainage, and irrigation practices

Many water systems, including privately owned systems, lack authority to implement this measure. Systems that have such authority must exercise it carefully. In general, restrictions on water use should be justified by the system's circumstances and should not unduly compromise the customer's rights or quality of service.

Integrated Resource Management [B]



Supply-side technologies. The idea of integrated resource management is that water often is used jointly with other resources. Systems following the Advanced Guidelines might have opportunities to consider and implement measures that can accomplish integrated resource management, where water conservation is jointly accomplished with the conservation of other resources. On the supply-side, the utility can institute operating practices (including various automation methods, strategic use of storage, and other practices) that achieve energy, chemical, and water savings. Source-water protection strategies, including land-use management methods, can be used to conserve water resources and avoid costly new supplies. Water and wastewater utilities can jointly plan and implement conservation programs to realize savings and share in the benefits.

Demand-side technologies. Integrative practices also can be accomplished on the demand side. Water and energy utilities can conduct comprehensive end-use audits and jointly promote conservation practices by end-users. Large-volume users can work with the utility to make adjustments to processes that reduce water and energy usage and wastewater flows, while saving other resources as well. Utilities that provide wholesale water can work with wholesale customers to design a water conservation program that will be mutually beneficial

Duane D. Baumann, John J. Boland, and W. Michael Hanemann, *Urban Water Demand Management and Planning* (New York: McGraw Hill, 1998): 254