Water Conservation, Efficiency and Reuse

A Report to
the Georgia Environmental Protection Division

Carl Vinson Institute of Government
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EXECUTIVE SUMMARY

Georgia enjoys a relatively plentiful water supply, yet the availability of our water resources varies both seasonally and regionally. When our natural water complexity is considered with regard to increasing water demands, it becomes apparent that Georgia must approach water management in a thoughtful, comprehensive and coordinated manner based on the best science we have. The following factors, taken together, underscore the need for such a comprehensive approach to water management.

1. **Weather/Climate**: Although Georgia is located in the humid southeastern United States and receives an average of 50 inches of annual precipitation, floods and drought are common and can significantly affect our water resources and how we use them. In fact, in the past two decades, Georgia has experienced the two worst droughts on record and a 100 and a 500-year flood.

2. **Geology/Hydrology**: Georgia encompasses portions of five physiographic provinces that vary in bedrock, soil, and topography, which result in an uneven distribution of water resources. North Georgia generally has more limited surface and ground water resources than south Georgia, which has larger rivers and one of the most prolific aquifer systems in the world. Even with the abundant water resources of south Georgia, pumping too much water from any one place at any one time can result in salt water intrusion or lowering of ground and surface water levels. These problems now face coastal Georgia, an area of high industrial and municipal withdrawals, and southwest Georgia, the agricultural irrigation center of Georgia.

3. **Demographics**: Between 1990 and 2000, the population of Georgia grew by 26.4 percent. This growth is projected to continue so that in the next 25 years, the state's population is expected to approach 12 million people. Population growth is not evenly distributed across the state, exacerbating resource stress caused by greater water demands. Most of the growth in population is expected to occur in the northern part of the state, which has more limited water resources than south Georgia. The second fastest growing region of the state is along the coast, an area faced with salt water intrusion in the Floridan Aquifer, the major water resource of the region.

4. **Economic Growth**: Although Georgia, like the rest of the nation, has been in an economic recession for the past few years, indicators suggest that economic activity is increasing. As our economy grows, demands for water increase to support our expanding industrial and commercial activities.

5. **Federal Laws and Policies**: Federal laws, such as the Clean Water Act and the Safe Drinking Water Act, set national requirements for water resources. In addition, several federal laws affect water resources including the Resource Conservation and Recovery Act, Endangered Species Act, National Environmental Policy Act, and others. Collectively, these federal laws set

parameters within which Georgia must operate. In addition, policies of federal agencies significantly affect Georgia's water resources. For example, the management of federal reservoirs by the U.S. Army Corps of Engineers largely determines flows in rivers, including the Chattahoochee and the Savannah.

6. **Neighboring States**: All of Georgia's major rivers, except those of the Altamaha, Satilla and Ogeechee basins, are shared with neighboring states. The Floridan Aquifer, the major aquifer in south Georgia, is also shared with Alabama, Florida, and South Carolina. Since 1990, Georgia has been in a dispute with Florida and Alabama regarding the management of the waters of two river systems. In addition, Tennessee and South Carolina have voiced concerns over shared water resources.

7. **The Courts**: Increasingly, decisions about water resources are being taken to court. Georgia has been in litigation over ground water use in coastal Georgia, water quality protection, and various other issues. The U.S. Constitution provides the federal courts with a role in resolving interstate disputes, including conflicts over shared water resources. Courts at all levels are becoming increasingly involved, however, in determining how water will be managed in Georgia.

8. **Technology**: Advances in technology have affected how we get water, transport water, treat water, use water, conserve water, and treat wastewater. In fact, technological changes are evident in every aspect of water management. Generally, technology helps us use water more efficiently, but in some cases, it can increase the stress we place on the water system.

9. **Knowledge**: We know a great deal more about our water resources today than we did in past eras. Research has improved our knowledge of how water resources systems work, and what is necessary to have healthy, functioning aquatic systems. Not only have we generated new water-related knowledge and insights, but our ability to communicate this new information has expanded greatly through formal and informal educational programs, the media, and the Internet.

10. **Value of Water**: Water is a valuable resource in many ways. It supports our economy and thus has value in the production of agricultural and industrial products. It has environmental value in that all life is dependent upon water. In addition to water needed to support bodily functions, water provides habitat, nurseries, and refuge for aquatic and terrestrial plants and animals. It has social and cultural value in that our lives are intertwined with water in countless ways. Water provides recreational and aesthetic values. Water not only supports life but it improves the quality of life in myriad ways. Further, growing scarcity of water, whether real or perceived, increases its value for all of these purposes.

These factors support the need for a comprehensive approach to managing water resources. The question is whether we have such a water management program in place and, if not, what will it take to create one.

The legal foundation upon which water management in Georgia rests is the set of statutes enacted by Congress and the Georgia General Assembly. Collectively, this body of law has set two general water-related goals for us to meet:

- Protect public health and environmental quality; and

- Meet future needs while protecting aquifers, instream uses and downstream users.

We face significant challenges, however, in meeting these goals. First, inconsistencies and lack of coordination can hamper meeting at least some of our goals. Laws are passed by different legislative bodies at different times, with different motivations, and for different purposes. They are implemented by federal and state agencies with varying degrees of financial, technical, and managerial capacity. Specific water-related decisions reflecting policies and programs are made by local government officials, private sector institutions, and the general public. Assuring coordination and avoiding inconsistencies in such a situation may be desirable but rarely occurs, at least to the extent necessary to fully meet the goals of the statutes.

A second challenge in meeting our water goals is that laws are not static. They reflect the values we attribute to water resources at a particular point in time. These laws also reflect the world as we know it—or can reasonably expect it to become—at the point in time when we conceive them. Congress and the General Assembly can amend these statutes, but they do not always change in lock step with a shift in citizens' goals, aspirations, perceptions, activities, and knowledge related to water resources.

To better address the water challenges we face, the Comprehensive State-wide Water Management Planning Act was passed by the Georgia General Assembly during the 2004 legislative session. This law directs the Environmental Protection Division of the Georgia Department of Natural Resources to develop a comprehensive state water management plan and creates the Georgia Water Council composed of legislators, legislative appointees and agency heads with water-related responsibilities to oversee the development of the plan. The plan is to be provided to the Council in July 2007, for its review and adoption and presented to the General Assembly for consideration in the 2008 legislative session.

The first iteration of the comprehensive water management plan will focus on four key policy objectives:

1. Minimizing withdrawals of water by increasing conservation, efficiency and reuse;

2. Maximizing returns to the basin through reducing interbasin transfers and limiting use of septic tanks and land application of treated wastewater where water quantity is limited;

3. Meeting instream and offstream water demands through storage, aquifer management and reducing water demands; and

4. Protecting water quality by reducing wastewater discharges and runoff from land to below the assimilative capacity of the streams.

These management objectives are interrelated, and policy options may relate to more than one objective. In addition, an option might be appropriate in one situation but not in another. Consequently, the plans should identify a variety of policy options that are consistent with stat and federal laws and usable in different situations. The most appropriate options can then be selected to address the water challenges unique to each river basin and aquifer in the state. The result will be that approaches may vary from region to region depending on water resources and demands, but that all regions will be consistent with the overall state water policy framework.

A series of four reports examines each of the management objectives in terms of current knowledge and policies adopted in other states. As we move through the planning process, the policy options will be considered by various advisory committees, presented at public meetings, and made available on the Georgia Water Council's website (www.georgiawatercouncil.org). The intent is to distribute the information widely and to have as much feedback as possible so that the most effective water management options are identified for use in Georgia.

This report is the first of four policy documents to focus on these objectives; specifically on increasing water conservation, efficiency, and reuse.

One advantage Georgia has over other states is that we are not on the cutting edge of developing policies, programs, technologies or other necessary means to create an effective water conservation program. Because we have enjoyed a relatively plentiful supply of water, we have not had to struggle with water conservation like many other states, particularly those in the West. Consequently, a great deal has been learned about how to effectively conserve water, use it more efficiently, and to reuse it. We can thus benefit from the knowledge gleaned by other states and regions to help put in place effective policies and programs in Georgia.

It was estimated that in 1995, 168 gallons of water were used per person per day in Georgia (for residential, commercial and industrial uses but not for agricultural or thermoelectric purposes). Nationally, the figure was 153 gallons per person per day. Thus, we averaged about 10 percent more water use per person in Georgia than nationally. Based on 2000 U.S. Geological Survey figures, however, it appears that Georgia reduced water use to the national level of 153 gallons per day. The year 2000 was the middle of the drought that, in Georgia, began in May 1998 and lasted until September 2002. Consequently, public awareness of the water situation was high and drought water restrictions were in place. Since the 2000 figures are the most recent data available, we do not know if per capita water usage has changed since the end of the drought.

Offsetting the reductions achieved through conservation, however, is the increase in Georgia's population. Between 1995 and 2000, when water withdrawals dropped by 10 percent, the population of state increased by about 13 percent. It is predicted that in the next 25 years, the population of Georgia will grow to about 12 million people, more than three million more than currently reside in the state. Most of this population growth will occur in North Georgia and along the coast, both of which are already experiencing water supply and water quality challenges. Although the recent drought showed that we can reduce our per capita water use on a short term basis, we are facing a chronic challenge to meeting water demand. Without comprehensively reducing demands while extending supplies where appropriate, we will not be able to meet the instream and offstream water needs of the future.

Water conservation, the "beneficial reduction in water use, waste, and loss," (Vickers 2001) is a broad and varied water policy area, potentially including widespread individual, governmental, and institutional involvement. Water efficiency, or using the least possible amount of water necessary to achieve a desired result, is generally considered an aspect of conservation. Water reuse (the use of reclaimed or recycled water), although specifically a water supply mechanism, is often used as one of the tools for conserving water resources. Thus, in referring to "water conservation" this report includes the concepts of water efficiency and reuse of reclaimed water.

The benefits of water conservation extend much further that preventing drought emergencies and extending our supply capacity. As an economic tool, conservation can prevent or delay the need for infrastructure expansion for both water and wastewater treatment and the need for additional short-term and long-term storage capacity. Water conservation can also be an important tool for the protection of water resources for public health and environmental purposes. When waste loads exceed assimilation capacity and a water supply is contaminated, it can be difficult and expensive to remediate; meanwhile, the cost of treating drinking water from that supply source escalates. Conservation practices can provide a dual benefit of helping to maintain natural flows and, by so doing, reducing the concentration of contaminants. In addition, aquatic habitat can be jeopardized not only by poor water quality, but also by chronically low flows and changes in downstream flows from storage reservoirs or excessive water withdrawals. Without adequate flows, rivers and streams are rendered incapable of supporting a full range of native plants and animals. Excessive water withdrawals also impact the natural values and functions of wetlands and estuaries.

However we look at it, water conservation is an objective that will nearly always pay for itself, resulting in a less expensive way of doing what we do and providing environmental and quality of life benefits at the same time.

Although we have enjoyed a generally plentiful supply of water, conservation, efficiency and reuse efforts are already widespread in the state. This is due to a variety of factors, including the economic and environmental benefits resulting from making better use of available water and requirements such as restrictions on outdoor watering. The basic

question relating to water conservation is whether the current efforts are sufficient or should the state adopt a more focused and better coordinated effort to conserve water. If a more concerted water conservation effort is necessary or desirable, a variety of policy options and conservation practices must be available for use by the appropriate water using sectors. For the purpose of this report, conservation practices are divided into five broad categories: Public Water Supply System Conservation, Residential Conservation, Commercial and Institutional Conservation, Industrial and Thermoelectric Conservation, and Agricultural Conservation. Categories were determined based on the dominant source of water (municipal supply versus direct withdrawal of surface or ground water), type and amount of use (large-scale versus small-scale or domestic versus industrial), and likely regulatory requirements (state-wide versus local).

Public Water Supply System Conservation: Water utilities, local governments, and/or state agencies in the states surveyed are generally required by statute to develop water conservation plans. These plans may include specific requirements for different classes of water users, and may be progressively more stringent over time or may call for conservation practices that are more stringent in some regions than others. In some cases, large water users must also develop water conservation plans. Most of the states provide guidelines or requirements for the development of such plans, which generally include the following elements for water utility conservation:

- Metering and submetering;
- Leak detection and control of unaccounted-for water;
- Encouragement of reuse of reclaimed water;
- Public education;
- Landscape irrigation/planting guidelines for property owners; and
- Plumbing standards and retrofit programs.

Residential Water Conservation: The states surveyed for this report place an emphasis on residential water conservation, particularly on landscape irrigation efficiency practices. Some state agencies are required to develop Xeriscaping and irrigation efficiency model ordinances or standards for use by local governments, and at least one state (Florida) has enacted statutory requirements for the use of rain sensors on automatic irrigation systems. Most of the states have implemented a program that encourages or requires water utilities to provide educational materials or opportunities for homeowners, and water utilities often supply kits for increasing water efficiency in the home. The most common residential water conservation practices used in the states surveyed are the following:

- Water-efficiency plumbing and appliances;

- Public education;
- Xeriscaping requirements; and
- Landscape irrigation standards.

Commercial and Institutional Water Conservation: Commercial and institutional water conservation is similar in many ways to residential water conservation, but may be tailored at least to some extent to the type of facilities targeted for conservation. More stringent requirements are generally established for institutional water conservation, as state facilities are often called upon to set water conservation examples for residents. It is common for state facilities to be required to adopt water conservation practices such as landscaping and irrigation standards, reuse of reclaimed water, and use of water-saving plumbing and fixtures. State facilities may also be required to conduct water audits to determine additional opportunities for increasing water use efficiency.

Industrial and Thermoelectric Water Conservation: Of all water conservation practices, those specific to industrial water conservation are the least likely to be required by statute because there is tremendous variability among industries in terms of how water savings can be accomplished. Not all of the states surveyed have developed water conservation standards specific to industrial facilities, but experiences in some states indicate that the key to industrial water conservation is to develop industry-specific and/or site-specific practices, or to require that industries develop water conservation practices to the greatest extent possible, based on technical and economic feasibility.

Agricultural Water Conservation: Appropriate practices for agricultural water conservation are site specific to some degree, but certain fundamental practices have shown to result in predictably significant water savings, such as retrofitting of irrigation systems to reduce evaporative water loss (removal of end guns, lowering of heads, and decreasing pressure), drip irrigation, and use of cover crops and mulches. Agricultural water conservation in the states surveyed is based primarily on the adoption of best management practices, adherence to water budgets, and/or site-specific technical assistance and training. Water budgets may be based on the types of crops irrigated, historical water use, regional conservation goals, and other parameters. Two states (California and Florida) improve irrigation efficiency through the use of mobile irrigation laboratories, which help irrigation system operators evaluate the potential for water savings. The other states provide irrigation efficiency assistance through other types of state agency activities.

The water we have is the least expensive water we can use and if we use it more wisely and use it over again, we will reduce the demands on our water resources for increased withdrawals.

Chapter 1

INTRODUCTION

Georgia is a complex state when it comes to water resources. Couple this natural water complexity with increasing water demands, and it becomes apparent that Georgia must approach water management in a thoughtful, comprehensive and coordinated manner based on the best science we have. To meet the challenges before us, we will need to adopt new practices to conserve water, return more water to the streams, help us balance offstream and instream water needs, and protect water quality. The following factors, taken together, underscore the need for such a comprehensive approach to water management.

1. **Weather/Climate**: Although Georgia is located in the humid southeastern United States and receives an average of 50 inches of annual precipitation, floods and drought are common and can significantly affect our water resources and how we use them. In fact, in the past two decades, Georgia has experienced the two worst droughts on record and a 100 and a 500-year flood.

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it improves the quality of life in myriad ways. Further, growing scarcity of water, whether real or perceived, increases its value for all of these purposes.

These factors support the need for a comprehensive approach to managing water resources. The question is whether we have such a water management program in place and, if not, what will it take to create one.

The legal foundation upon which water management in Georgia rests is the set of statutes enacted by Congress and the Georgia General Assembly. These statutes relate both directly and indirectly to our water resources. Statutes are implemented through a series of rules, policies, and programs by various departments of federal and state governments. One must look to the statutes themselves for either explicit or implicit expression of our goals for managing water resources. These "goals" (i.e., the outcomes we seek to achieve) reflect best how we collectively, as citizens of the United States and of Georgia, value the attributes of our water resources.

The laws that express our goals vary. Some laws reflect the broader goals of Americans and were passed by Congress. Federal statutes, such as the Clean Water Act, Safe Drinking Water Act, Endangered Species Act, Coastal Zone Management Act, and others, identify overarching goals that have been embraced, to varying degrees, by Georgia statutes. By enacting state laws that are at least as stringent as the federal laws, the state is able to receive primacy, or the responsibility to implement federal policies and programs in Georgia. The primacy mechanism applies to environmental laws administered by the U.S. Environmental Protection Agency (USEPA), such as the Clean Water Act and the Safe Drinking Water Act. Primacy, however, does not apply to all laws. For example, the Endangered Species Act is administered exclusively by the U.S. Fish and Wildlife Service. If there is sufficient change in collective American values or goals relating to water resources management, Congress adds to or amends federal laws to reflect this change; the State of Georgia alone cannot alter the federal requirements.

Some state statutes are Georgia specific and not driven by federal directives. State statutes include the Erosion and Sedimentation Control Act, Safe Dams Act, Georgia Planning Act, the Coastal Marshlands Protection Act, and others. In addition, states have the authority to determine how water should be allocated to various water users. Georgia has enacted legislation establishing permitting requirements for withdrawals of over 100,000 gallons per day of surface and ground water. These laws were enacted by the Georgia General Assembly and reflect goals and values of Georgians. Together, these federal and state statutes serve as the foundation for our water management programs.

Collectively, this body of law has set two general water-related goals for us to meet.

- Protect public health and environmental quality; and

- Meet future needs while protecting aquifers, instream uses and downstream users.

We face significant challenges, however, in meeting these goals. First, inconsistencies and lack of coordination can hamper meeting at least some of our goals. Laws are passed by different legislative bodies at different times, with different motivations, and for different purposes. They are implemented by federal and state agencies with varying degrees of financial, technical, and managerial capacity. Specific water-related decisions reflecting policies and programs are made by local government officials, private sector institutions, and the general public. Assuring coordination and avoiding inconsistencies in such a situation, while desirable, rarely occurs, at least to the extent necessary to fully meet the goals of the statutes.

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Problems Resulting from Uncoordinated Water Management

Some examples of the need for a more comprehensive, thoughtful, and coordinated approach to water management may be instructive.

- **Protecting Water Quality**: Our efforts to meet water quality standards have focused primarily on reducing contamination through controlling discharges from industries and municipalities. We have accomplished a great deal nationally and in Georgia by reducing pollutants that enter our waterways through these industrial and municipal wastewater discharges. Streams, rivers, and lakes across the country are cleaner today than they were when the Clean Water Act was passed in 1972. However, as we reduced the contaminant load from these point sources, and as our knowledge of the impacts of nonpoint sources (e.g., runoff from land) increased, land use changes were outpacing our efforts to address resultant nonpoint sources.

  Georgia's Erosion and Sedimentation Control Act, passed in 1975, only addresses runoff from certain construction activities. It does not deal with the direct relationship between post-construction land use and nonpoint pollution; nor does it address the broad array of nonpoint pollutant types—such as nutrients, heavy metals, and synthetic organic compounds—that enter our waterways as a result of post-construction land-use practices. The Act also assigns responsibilities to multiple state agencies and to local governments who wish to implement the requirements within their jurisdiction.

  In the effort to render our waters safe and healthy, the federal government, through its executive and judicial branches, recently has increased its focus on controlling nonpoint sources as a pollution management tool. Both the USEPA and the Georgia Environmental Protection Division (EPD) have worked to control

stormwater discharges. Since the first flush of stormwater carries most of the nonpoint pollutants to streams, collecting and/or otherwise treating this stormwater can help improve water quality. Additionally, the federal court system has required USEPA, and by extension EPD, to develop total maximum daily loads (TMDLs) in order to bring those streams that do not meet water quality standards into compliance with the Clean Water Act.

In Georgia, there are over 6,000 miles of streams that have been assessed that do not meet water quality standards; most of these impairments are due to nonpoint source pollution. To improve coordination of the nonpoint source control efforts, the Georgia General Assembly enacted House Bill 285 in the 2003 legislative session. This statute better aligns erosion and sedimentation control requirements under state law with stormwater control requirements under the federal Clean Water Act. This legislation will result in better coordination, but to be truly effective, the efforts of federal, state, and local governments, as well as private land owners, must work in concert to protect our waterways from nonpoint pollution.

- **Maintaining Healthy Aquatic Systems**: Achieving and maintaining healthy aquatic systems was built into our statutory foundation for water management in the 1970s when the Clean Water Act made it a national goal to have "fishable" and "swimmable" waters. The term "fishable waters" implies a healthy aquatic habitat that supports fish. Additionally, the Clean Water Act declares that "[t]he objective of this Act is to restore and maintain the chemical, physical and biological integrity of the Nation's waters." To restore and maintain the biological integrity of our waterways, Congress intended that this federal water quality law protect healthy aquatic communities. So too, the Endangered Species Act was designed to protect both terrestrial and aquatic species.

  To obtain primacy for implementing the provisions of the Clean Water Act in Georgia, the Georgia Water Quality Control Act, first passed in the 1950s and amended in the 1960s, was again amended by the General Assembly to incorporate federal requirements for healthy aquatic systems. Thus maintaining the biological integrity of Georgia's waters was incorporated as a goal for the state. Although the Georgia General Assembly enacted the Georgia Endangered Wildlife Act and the Wildflower Preservation Act in 1973, these laws are much narrower in scope than the federal Endangered Species Act that, as noted above, does not have a primacy provision. Consequently, the goal to have healthy aquatic systems has been in place at the federal level and, to a lesser extent at the state level, since the 1970s. That goal has not changed.

  What has changed over the past few decades is our understanding of what is required to achieve that goal. In 1972, when the Clean Water Act was passed, it was anticipated that improving water quality would enable us to have healthy aquatic systems. Now, it is clear that we also must maintain sufficient stream

flow—as well as flow patterns that mimic the natural flow regime—in order to maintain healthy communities of fish and other aquatic organisms.

The Supreme Court of the United States has determined that states have retained the authority to allocate water to users within their borders. The Georgia General Assembly enacted the Georgia Groundwater Use Act in 1972 and amended the Georgia Water Quality Control Act in 1977 to provide for a water allocation system that requires major water users to obtain water withdrawal permits from EPD. Before issuing a withdrawal permit, EPD evaluates water withdrawal permit applications to determine if the withdrawal will have an unacceptable adverse impact on the water resource or other water users.

For surface water withdrawals, EPD formerly used annual 7Q10 (e.g., the annual average of a stream segment's 7-day low flow, with a frequency of occurrence of once in ten years) as the standard with which to determine if, after a withdrawal, a sufficient amount of water would be left in the stream for instream uses. Through the 1990s strong scientific evidence was developed that annual 7Q10 was not a sufficient amount of water to maintain a healthy aquatic system. In 2001, the Board of Natural Resources adopted an interim instream flow policy designed to increase the amount of water remaining in streams—after withdrawals—for instream uses, but that change still may be insufficient. As our knowledge improves, new management actions may be necessary to meet our goals. We also may find it necessary to consider changing our goals to reflect our new knowledge.

- **Integrating Water Quality and Quantity Management**: As more water is withdrawn from streams and less is returned, the capacity of the streams to assimilate wastewater discharges decreases. There is simply less water available to dilute pollutants. Currently a number of streams and rivers in the state are above or approaching their limits for assimilating wastewater—not to mention limitations on their ability to meet off stream water demands for public supply, industrial uses, thermoelectric power production, and agricultural irrigation. Similarly, large withdrawals of ground water along the coast have allowed salt water to intrude into the aquifer upon which most coastal residents depend. Meeting our demands for water while ensuring sufficient water is left in the stream to meet instream needs and in the aquifer to maintain hydrologic balance is a significant challenge that will require greater coordination than we currently have.

- **Integrating Surface and Ground Water Management**: Flow in streams during drought periods comes largely from ground water. This is true throughout the state, but it is even more significant in karst areas where dissolvable bedrock (i.e., limestone, dolomite) is at or near the surface. In Georgia, this includes both the southwest and northwest portions of the state. In the lower Flint River basin, it has been estimated that—over an extended dry period—every gallon of water withdrawn from the Floridan Aquifer decreases the amount of ground water that

> seeps into streams by 0.6 gallons. This is a high irrigation region of the state, therefore, large withdrawals of ground water during dry periods may have a significant impact on the amount of water in streams. Similarly, large withdrawals of ground water along the coast have resulted in decreases in artesian pressure that reduces ground water discharge to wetlands and streams in portions of this area. To avoid surface water problems relating to inadequate flows, it is increasingly necessary to consider the potential impacts of ground water withdrawals on streams, lakes, and estuaries.

When water management values, statutes, rules or programs change in an uncoordinated fashion, there is an inevitable conflict between our goals/aspirations and the rules/policies/programs that seek to achieve them. Here in Georgia, "new values" have largely grown out of lessons we have learned: 1) by programmatically implementing "old" rules and policies; and 2) from vast leaps forward in the state of our knowledge regarding the physical, chemical, and biological functions of our water systems. Generally, we have addressed these conflicts between "old" programs and "new" values in an issue-by-issue, piece-meal fashion through the legislative process, followed by "fixes" to individual rules and programs. A more comprehensive approach is rarely an option due to the cost in time and resources.

A New Opportunity

An opportunity to comprehensively address water management concerns began with the creation of the Joint Comprehensive Water Plan Study Committee and the Water Plan Advisory Committee during the 2001 legislative session of the Georgia General Assembly. Legislation, based on this effort, was passed in the 2004 legislative session and reflects the most recent articulation of a water vision and guiding principles for water planning in the state. The General Assembly incorporated the study committee's overall vision for Georgia's water resources as the state water management goal in the Comprehensive State-wide Water Management Planning Act:

> Georgia manages water resources in a sustainable manner to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens.

This vision encompasses the concept of sustainability that has never been articulated in earlier goals. It also recognizes the interrelationship of the economy, environmental quality, and quality of life.

Additionally, the study committee identified nine principles to guide the development of the state-wide comprehensive water management plan. These guiding principles were incorporated in the Act:

1. Effective water resources management protects public health, safety and welfare of Georgia's citizens.

2. Water resources are managed in a sustainable manner so that current and future generations have access to adequate supplies of quality water that supports both human needs and natural systems.

3. All citizens have a stewardship responsibility to conserve and protect the water resources of Georgia.

4. Water management efforts recognize that economic prosperity and environmental quality are interdependent.

5. Water quality and quantity and surface and ground water are interrelated and require integrated planning as well as reasonable and efficient use.

6. A comprehensive and accessible database is developed to provide sound scientific and economic information upon which effective water management decisions can be based.

7. Water resource management encourages local/regional innovation, implementation, adaptability and responsibility for watershed and river basin management.

8. Sound water resources management involves meaningful participation, coordination and cooperation among interested and affected stakeholders and citizens as well as all levels of governmental and other entities managing and/or utilizing water.

9. Periodic revisions of the plan are required to incorporate new scientific and policy insights, as well as changing social, economic, cultural, and environmental factors.

The General Assembly has thus created a framework for developing Georgia's first comprehensive state-wide water management plan by providing a vision/goal for water management and guiding principles for developing the plan.

The planning process must:

1. evaluate water trends and conditions to determine the types of challenges that we face now or will face in the future;

2. evaluate our legal/management structure (i.e., statutes, rules, programs, policies) to address those challenges;

3. identify gaps and other weaknesses in our water management approach; and

4. identify options for addressing these gaps and weaknesses and the benefits and drawbacks of each option.

The plan will initially focus on four interconnected water management objectives:

1. Minimize withdrawals of water by increasing water conservation, efficiency and reuse;

2. Maximize returns to the basin of origin by managing interbasin transfers, the use of on-site sewage disposal systems, and land application of treated wastewater where water quantity is limited;

3. Meet instream and off stream demands for water through efficient surface storage, aquifer management and reducing water demands (see number 1); and

4. Protect water quality by reducing pollutant loadings from discharges and runoff from the land to ensure the assimilative capacity of the streams is not exceeded and aquatic life is not impaired.

These policy objectives are complementary, with the overall goal to maximize the amount of water available for both humans and natural systems such that our water resources are sustained in a healthy balance within each river basin and aquifer. In order to achieve this goal, an overarching focus must be on preserving instream flows and ground water levels. Instream flow ranges should be protective of water quality, aquatic ecosystems, and the legal responsibility to provide adequate flows for downstream users. Ground water levels should be maintained to prevent salt water intrusion and adverse impacts to surface water flows and to sustain long-term use of the aquifer.

The first objective, to minimize withdrawals through conservation, efficiency, and reuse, will help reduce the need for increased water supplies as our population and water demands grow. Making better use of the available water is usually the least costly alternative for meeting water demands. Water conservation is certainly not a new concept, but its practice should be stressed in order to better meet both instream and offstream demands for water.

The second objective, to maximize returns to the basin of origin (and thus help maintain adequate instream flow in each river basin) focuses on reducing interbasin transfers and judiciously using septic tanks and land application of treated wastewater. Each of these may be useful water management tools, but without careful management, they may threaten the balance of water resources in the basin of origin. Interbasin transfers may be necessary and desirable in some instances, but the benefits to the importing basin must be weighed against the instream and offstream costs to the exporting basin. Septic tanks are important for protecting water quality in rural areas, however, as proliferation of septic tanks has accompanied sprawling suburban growth, how much of the residential water supply is being returned to its basin of origin? Finally, land application of treated wastewater can be beneficial if used to irrigate land where potable water might otherwise be used, but as a wastewater discharge tool, its benefits should be examined relative to the costs of direct discharges of treated wastewater.

The third objective, meeting offstream water needs during seasonal shortages while maintaining instream values, emphasizes the need to balance human water demands with the needs of aquatic systems. Reservoirs provide valuable water storage for municipal, agricultural, industrial, and commercial needs, but they come with monetary and environmental costs that must be considered. Ground water is often connected to surface water systems and must be managed to help preserve instream flows as well as to sustain ground water quality and quantity over time. Conjunctive use of surface water and ground water, such as aquifer recharge and aquifer storage and recovery (ASR), can provide seasonal and year-to-year storage options that should be weighed with other options in terms of storage utility and environmental integrity.

The fourth management objective, protecting water quality by reducing wastewater discharges and runoff from land to below the assimilative capacity of the streams, is related to the previous management objectives in that the greater the instream flow, the greater the assimilative capacity of streams. While the other management objectives focus generally on managing water quantity, which impacts water quality, this objective focuses rather on mechanisms that can be used to reduce direct and indirect discharges.

As stated above, these management objectives are interrelated and need to be considered in a comprehensive manner. To do so will require that a variety of policy options be available and that, from these available options, the most appropriate ones be selected to address the water challenges unique to each river basin and aquifer in the state. The result will be that approaches may vary from region to region depending on water resources and demands, but that all regions will be consistent with the overall state water policy framework.

A series of four reports examines each of the management objectives in terms of current knowledge and policies adopted in other states. As we move through the planning process, policy options will be considered by various advisory committees and be presented at public meetings and made available on the Georgia Water Council's website (www.georgiawatercouncil.org). The intent is to distribute the information widely and to have as much feedback as possible so that the most effective water management options are identified for use in Georgia.

Water Conservation

Water conservation, the "beneficial reduction in water use, waste, and loss," (Vickers 2001) is a broad and varied water policy area, potentially including widespread individual, governmental and institutional involvement. Water efficiency, or using the least possible amount of water necessary to achieve a desired result, is generally considered an aspect of conservation. Water reuse, or the use of reclaimed or recycled water, although specifically a water supply mechanism, is often used as one of the tools for conserving water resources. Thus, in referring to "water conservation" this report includes the concepts of water efficiency and reuse of reclaimed water.

Water conservation has proven to be the most economical and environmentally protective management tool for meeting water supply challenges (Gleick et al. 2003, Levin et al. 2002, USEPA 2002, Vickers 2001, Gleick 2002). While individual water conservation initiatives can result in success, coordinated, consistent, and long-term efforts tend to produce the greatest rewards in terms of water resource protection and sustainability. Traditionally, because of our relatively plentiful water supplies, Georgians have generally taken a reactive approach to water conservation: during water shortages, we implement water use restrictions. However, as our population grows and water demands intensify, it is becoming increasingly important to manage supply and demand issues on an on-going basis. Decisions made now regarding water conservation, efficiency, and reuse will play a key role in water resource issues of the future.

The benefits of water conservation extend much further than preventing drought emergencies and extending our supply capacity. As an economic tool, conservation can prevent or delay the need for infrastructure expansion for both water and wastewater treatment and the need for additional short-term and long-term storage capacity. It also reduces the per capita cost of water treatment and delivery because without conservation, costs are inflated by wasteful use and unnecessarily high peak demands. By flattening the demand curve that tends to peak with summertime outdoor water use, conservation allows water supply and wastewater facilities to more easily meet the demands of new growth without facility expansion or new supplies. According to the U.S. Environmental Protection Agency's (USEPA) *Water Conservation Guidelines*, conservation "becomes even more valuable over time because future water supplies and the facilities needed to deliver them are expected to cost more (even when adjusting for inflation). In other words, permanent conservation savings that are realized today will have increasing value into the future."

Water conservation can also be an important planning tool for the protection of water resources for public health and environmental purposes. The close link between water quality and water quantity has become increasingly clear. Adequate flow levels are needed to maintain the waste assimilation capacity of rivers and streams. When waste loads exceed assimilation capacity and a water supply is contaminated, it can be difficult and expensive to remediate; meanwhile, the cost of treating drinking water from that supply source escalates. Conservation practices can provide a dual benefit of helping to maintain natural flows and, in doing so, reducing the volume of wastewater discharges and the volume of urban runoff and associated contaminants.

Aquatic habitat can be jeopardized not only by poor water quality, but also by chronically low flows and changes in downstream flows from storage reservoirs or excessive water withdrawals. Research is being conducted worldwide regarding the importance of maintaining a natural flow regime; however managed, without adequate flows, rivers and streams are rendered incapable of supporting a full range of native plants and animals. Excessive water withdrawals also impact the natural values and functions of wetlands and estuaries.

However we look at it, water conservation is an objective that will nearly always pay for itself, resulting in a less expensive way of doing what we do and providing environmental and quality of life benefits at the same time.

Water Efficiency

To a large extent, increased water efficiency is related to technological advancements.

Technology frequently enables us to do more with less water. New technologies which are more water efficient have been adopted by businesses and industries across the country, not only to make better use of available water, but because they improve product competitiveness due to reduced production costs, reduced regulatory burdens, and enhanced company image. For example, new technology has enabled a titanium mining company in Georgia, Iluka Resources, to reduce water consumption by more than 50 percent (Grillo 2005).

Water conservation and energy conservation are closely linked. Energy is generally required to move water (unless gravity is involved because water flows downhill) and to treat water and wastewater. It is also used to heat and cool water**.** Either through hydroelectric facilities or thermoelectric facilities, water is needed to produce electricity. In fact, thermoelectric power production (i.e., from fossil fuel and nuclear power plants) has been the biggest single offstream withdrawer of water in Georgia. However, through new system design for reuse of cooling water and improved efficiency with use of new technology, the amount of water required to produce electricity has dropped dramatically. The average number of gallons of water used to produce one kilowatt-hour[1] of electricity nationally decreased from 63 gallons in 1950 to 21 gallons in 2000. (Hutson et al. 2004) While this is truly significant, if also illustrates that if we can save one kilowatt-hour of electricity, we can conserve 21 gallons of water. Since one kilowatt-hour in the southeast costs about eight cents, it seems little to pay for conserving water.

In agriculture, new irrigation systems are designed to be more water efficient. Putting water on crops with lower pressure and releasing it closer to the ground results in less evaporation loss and a greater percentage of the water being available to the plants.

At the public water and wastewater system level, increased water efficiency is also evident. This is probably nowhere more noticeable than in leak detection and practices to reduce water lost to the system through leaking pipes. Technology has enabled water utilities to identify where water leaks are occurring and to fix them more efficiently and effectively.

New technologies have also enabled water to be used more efficiently at home. Dishwashers, washing machines, toilets, and water heaters are all designed to be more

[1]According to energyvotex.com/energy dictionary, one kilowatt-hour is the energy required to operate a 40-watt lightbulb for a full day, a 19 inch color television for about four hours, a personal computer for 2.5 hours, an electric hairdryer for 30-60 minutes, an electric razor for 36 hours, and a clothes dryer for 15 minutes.

efficient than in the past. Automatic watering systems with rain sensors allow lawns and gardens to be watered only when needed. Public education, however, is necessary to inform people about the importance of water conservation and the options available to reduce water use.

Across all water using sectors, efficient use of water is critical if we are to meet the water demands of the future. However, costs are associated with buying and installing new technology. Consequently, it is generally necessary to build in time for technological changes to occur. Over time, new technology will replace old technology and result in use of less water.

Reuse of Reclaimed Water

Reuse of reclaimed water can be a valuable component of a water conservation program because it decreases reliance on other sources of water and may lower treatment costs. For example, reclaimed water systems in Florida supplied approximately 580 million gallons of water per day in 2002, and system capacity for reclaimed water in the state is in excess of a billion gallons of water per day. (Munson et al. 2005) Reuse also offers a means for wastewater management that decreases environmental impacts associated with waste discharges into surface waters. *Reclaimed* water, sometimes referred to as "graywater," or "recycled" water, includes domestic wastewater that has been treated to the extent that it is suitable for a variety of nonpotable uses. The most common use is for irrigation of residential, commercial, and public landscapes, but reclaimed water is increasingly used for industrial processes, fire protection, aesthetic purposes such as fountains, agricultural irrigation (feed crops), and dust control. In commercial and industrial applications, process or cooling water may be reused in closed loop systems. When such a system is used, the only additional water that is needed is water to replace that tied up in the process or lost through evaporation.

In some parts of the world, wastewater is highly treated through advanced processes such as reverse osmosis and is suitable for drinking. This practice is generally prohibited in the United States in the interest of public health. Direct treatment of wastewater to drinking water standards can be significantly more expensive than treatment of water withdrawn from streams, rivers or ground water. Public perceptions of the consumption of wastewater, however highly treated, are a further impediment to this practice.

Most areas where nonpotable reclaimed water is used are open to public access, making public health a primary concern. Regulations for treatment, dedicated delivery lines, signage, and public education are important protection mechanisms. Current regulations in Georgia require a wastewater treatment plant to obtain a permit for providing reclaimed water to the community, and each designated user of the water must enter into a written user agreement with the permittee. Runoff or direct discharge of reclaimed water requires a National Pollutant Discharge Elimination System (NPDES) permit. (Georgia EPD 2002)

The Importance of Water Conservation

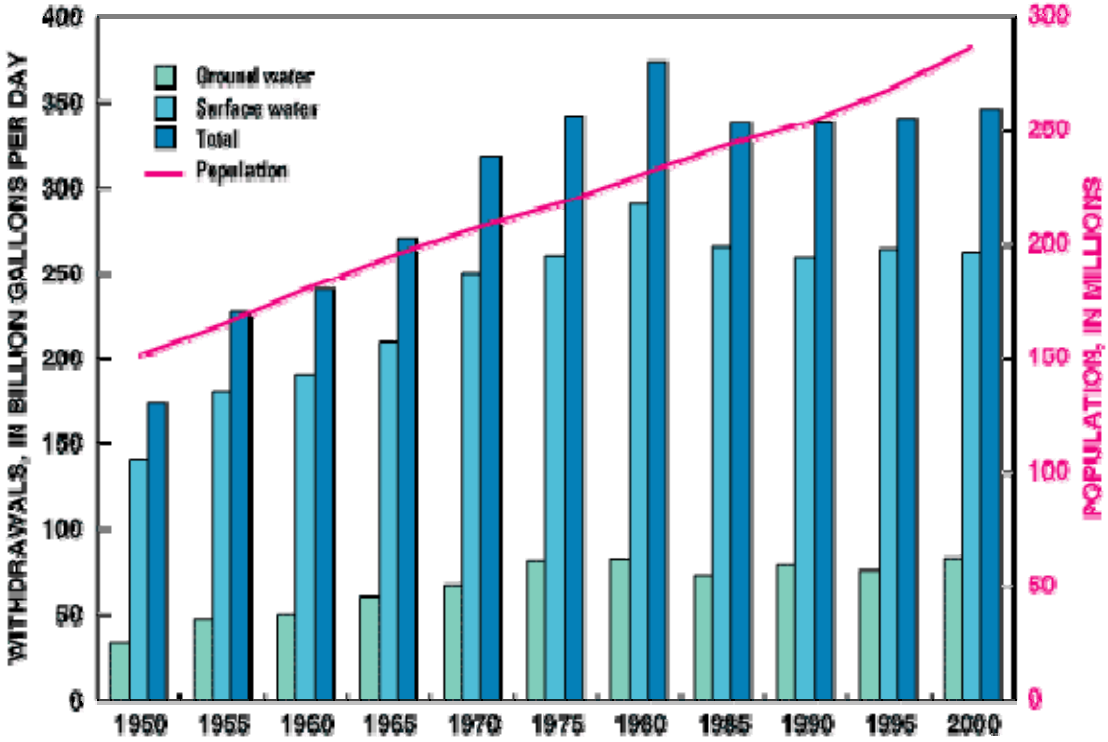
If we are to meet the increasing demands being placed on our water resources, we must increase our efforts relating to conservation, efficiency, and water reuse. The water we have is the least expensive water we can use, and if we use it more wisely and use it over again, we will reduce the demands on our water resources for increased withdrawals.

Chapter 2

CURRENT STATUS OF WATER CONSERVATION IN GEORGIA

Today, water users in the United States are making more efficient use of water resources. As shown in Figure 1, as the population of the United States has increased, the amount of water withdrawn has leveled off.

Figure 1
Water Withdrawals and Population Trends in the United States
(1950-2000)



Source: U.S. Geological Survey.

Like many states, Georgia is witnessing an increase in water conservation, efficiency, and reuse. This is due to a variety of factors including the economic and environmental benefits that result from making better use of available water and new requirements such as restrictions on outdoor watering. However, it is difficult to quantify water conservation efforts because they result from a host of public and private decisions, and data relating to these decisions are generally not available. We thus have anecdotal information about water conservation but lack comprehensive data to determine how widespread and effective current efforts are.

We do, however, have some data on water withdrawals. Although statewide public supply water use increased steadily since 1980, corresponding to population increase, industrial water use fluctuated during this same period because of improved water efficiency, water recycling, and conservation practices at industrial plants (Fanning, 2003). In 1995, an estimated 168 gallons of water were used per person per day in Georgia. (This figure includes residential, commercial and industrial uses but not agricultural or thermoelectric withdrawals.) Nationally, the figure was 153 gallons per person per day. By 2000, however, Georgia reduced water use to the national level of 153 gallons per day (Hutson et al. 2004). The year 2000 was the middle year of a five-year drought in Georgia that lasted from May 1998 through September 2002. Consequently, public awareness of the water situation was high and drought water restrictions were in place. This suggests that conservation practices do work, although, because the 2000 figures are the most recent data available, it is not yet known if per capita water usage in the state has changed since the end of the drought.

Offsetting the reductions achieved through conservation, however, is the increase in Georgia's population. Between 1995 and 2000 when water withdrawals dropped by 10 percent, the population of the state increased by about 13 percent. It is predicted that in the next 25 years, the population of Georgia will grow to about 12 million people; more than three million more than currently reside in the state. Most of this population growth will occur in North Georgia and along the coast, both of which are already experiencing water supply challenges. Although the recent drought showed that we can reduce our per capita water use on a short term basis, we are facing chronic water demand challenges. Without comprehensively reducing demands while extending supplies where appropriate, we will not be able to meet the instream and offstream water needs of the future.

While Georgia was able to respond to the recent drought, the question of whether we can meet the state's future water demands with our current water conservation policies remains. To answer this question, we must first consider what policies and programs are currently in place.

Federal Water Conservation Policies and Programs

Federal Statutes

Three federal laws affect water conservation, efficiency, and reuse: the Clean Water Act, the Safe Drinking Water Act, and the Energy Policy Act. The Clean Water Act is focused primarily on water quality in our streams, rivers and lakes. It also establishes the National Pollution Discharge Elimination System (NPDES) permit requirements. Anyone discharging wastewater into a water body in the United States is required to have an NPDES permit which determines the water quality criteria that must be met by the discharger. Although this law is centered on water quality, industries are encouraged to use water more efficiently because they want to meet the Act's requirements in a cost effective manner. The Clean Water Act also plays a significant role in encouraging the reuse of wastewater as an alternative to discharging it into waterways.

The Safe Drinking Water Act (SDWA) protects public health by ensuring that public drinking water is safe. The 1996 amendments to the law called for the U.S.

Environmental Protection Agency (USEPA) to publish guidelines for water conservation plans for public water systems within two years of the Act's passage. These guidelines (published on April 21, 1998) are meant to be a supplement rather that a replacement for state conservation programs, and the development and implementation of water conservation programs is voluntary. The SDWA also provides that states may require public water systems to submit conservation plans when applying for Drinking Water State Revolving Fund Loans established by the 1996 amendments.

Individual states may decide whether to use the guidelines in their entirety, to require plans in conjunction with Revolving Fund programs, or to modify the guidelines to meet state needs. However, if water conservation plans are required for Revolving Fund Loan applications, the planning process must be in keeping with the federal Revolving Fund Loan guidelines. The state may allow Revolving Fund Loan monies to be used for water conservation plan preparation. In Georgia, these funds are administered by the Georgia Environmental Facilities Authority (GEFA) for a variety of drinking water infrastructure projects.

Finally, the Energy Policy Act of 1992 establishes national allowable water-flow rates for toilets, urinals, showerheads, and faucets made for home use:

Water Use	Amount of Water
Toilets	1.6 gallons per flush (gpf)
Urinals	1.0 gpf
Showerhead	2.5 gallons per minute (gpm)
Faucets and replacement aerators	2.5 gpm

None of these federal laws provides a comprehensive approach to water conservation, but they all provide policy tools that help states reduce their water use.

Federal Agencies

Two federal agencies, the USEPA and the U.S. Geological Survey (USGS) have primary responsibilities relating to water conservation. The U.S. Department of Energy also has responsibility, as do many other agencies, for particular activities within their realm of influence that relate to water conservation.

U.S. Environmental Protection Agency

The USEPA's Water Efficiency Program offers extensive information on water conservation and drought management, conservation pricing, reuse of reclaimed water, and other water management issues through its web site (www.epa.gov/owm/water-efficiency). In addition, USEPA's Environmental Education for Teachers and Students web site provides educational resources on various subjects, including water conservation (epa.gov/teachers/).

U.S. Geological Survey

The U.S. Geological Survey has compiled data on water use throughout the country at five-year intervals since 1950. The USGS reports now provide information on water use in eight categories: public supply, domestic, irrigation, livestock, aquaculture, industrial, mining, and thermoelectric power. The USGS also maintains a web site, "Water Science for Schools," which has extensive information on water, including water conservation basics (ga.water.usgs.gov/edu/).

State Role in Water Conservation

Georgia Law

Georgia Ground Water Use Act and the Georgia Water Quality Control Act

A number of state laws relate to water conservation. Two statutes, the Georgia Ground Water Use Act of 1972 and the 1977 amendments to the Georgia Water Quality Control Act, establish the water withdrawal permitting program for users of 100,000 gallons or more of water per day.

Permits from the Environmental Protection Division (EPD) of the Georgia Department of Natural Resources are required for surface and ground water withdrawals of 100,000 gallons or more of water per day. All applications for new or increased surface water withdrawals, except for permits solely for agricultural use, must contain a water conservation plan approved by the EPD director and based on guidelines issued by EPD (O.C.G.A. §12-5-31(d)). The water conservation plan must "promote the conservation and reuse of water within the state, guard against a shortage of water within the state, promote efficient use of the water resource, and be consistent with the public welfare of the state" (O.C.G.A. §12-5-31(h)). For a ground water withdrawal permit of or in excess of 100,000 gallons a day to be granted, EPD or the Board of Natural Resources considers a regional water development conservation and sustainable use plan, where applicable (O.C.G.A. §12-5-96(d)(9)). Such a plan may be developed by EPD or a party designated by EPD. It must "serve to promote the conservation and reuse of water within the state, guard against shortages of water within the state and region, and promote efficient use of water resources…" (O.C.G.A. §12-5-96(e)).

Metropolitan North Georgia Water Planning Act

In 2001, the Georgia General Assembly passed the Metropolitan North Georgia Water Planning Act which created a planning entity dedicated to developing comprehensive regional and watershed specific plans to be implemented by the 16-county governments and the municipalities located within the district. The act calls for the creation of a water conservation management plan which builds upon and is coordinated with existing watershed planning efforts taken by local governments within the district (O.C.G.A. §12-5-584(a)). Local government applications for water supply withdrawal or wastewater discharge cannot be approved by EPD unless the local government is in compliance with the applicable provisions of the water conservation plan or is making a good faith effort

to come into compliance. If a local government within the district fails to comply with the water conservation plan, the entity will be ineligible for state grants or loans for water supply and conservation projects (O.C.G.A. §12-5-584(d)(4)).

Georgia State Plumbing Codes

In order to promote greater efficiency in residential and commercial water use and to reduce consumer water and energy costs by reducing indoor water use, all residential and commercial buildings constructed after 1992 must be installed with low flow toilets, shower heads, and faucets (O.C.G.A. §8-2-3(b)). This requirement was meant to generate consumer awareness of the need to conserve water as well as the benefits and financial savings that can accrue by reducing the need for new water supplies and treatment facilities, lowering operation and maintenance costs for water and sewer utilities, and reducing the amount of energy used to heat, treat, and transport water (O.C.G.A. §8-2-2).

Tax Credit for Water Conservation Facilities and Qualified Water Conservation Investment Property

Any Georgian taxpayer who financially participates in qualified water conservation investment is allowed a tax credit in the taxable year following that in which the modified manufacturing process or the new or expanded water conservation facility has been placed in service and in which the taxpayer has initiated a minimum ten percent reduction in permit by relinquishment or transfer of annual permitted water usage from existing permitted ground water sources. A qualified water conservation investment is defined as all spending by a taxpayer for the modification of existing manufacturing processes, for the construction of a new water conservation facility, or for the expansion of an existing water conservation facility (O.C.G.A. §48-7-40.10(a)(2)). A water conservation facility is any facility, buildings, and machinery and equipment used in the water conservation process that results in a ten percent reduction in permit by relinquishment or transfer of annual permitted water usage from existing ground water sources (O.C.G.A. §48-7-40.10(a)(4)). The amount of the tax credit allowed is a percentage of the taxpayer's qualified water conservation investment (O.C.G.A. §48-7-40.10(b)). In order to qualify for the tax credit, the modified manufacturing process or the new or expanded water conservation facility must have been placed in service after January 1, 1997. In addition, the tax credit may only be taken with respect to projects costing $50,000 or more (O.C.G.A. §48-7-40.10(c)(1)). For every year in which the taxpayer claims the credit, he must include among other information:

- The amounts, dates, and nature of the qualified water conservation investments which have allowed a modified manufacturing process or a new or expanded water conservation facility to be placed in service;

- The amount and date of reduction in permitted ground water usage occurring as a result of this investment; and

- The amounts of qualified water conservation investment reported (O.C.G.A. §48-7-40.10(c)(1)(A)(B)(D)).

If, following approval for the water conservation credit, the annual permit for water usage from the same ground water source is increased, any unused credits will expire immediately (O.C.G.A. §48-7-40.10(c)(5)).

Tax Credit for Shift from Ground Water Usage

A taxpayer who shifts from ground water usage during a taxable year is allowed an annual tax credit starting in the fourth taxable year after the taxable year in which the shift from ground water usage occurred (O.C.G.A. §48-7-40.11(b)). A shift from ground water usage is defined as a minimum ten percent transfer of annual permitted ground water usage from ground water sources due to the purchase of water from a qualified water conservation facility (O.C.G.A. §48-7-40.11(a)(2)). The use of the facility must have been certified by the Department of Natural Resources as necessary to promote its ground water management efforts for areas with a multi-year record of consumption at, near, or above sustainable use signaled by declines in ground water pressure, threats of salt-water intrusion, need to develop alternate sources to accommodate economic growth and development, or any other indication of growing inadequacy of the existing resource (O.C.G.A. §48-7-40.11(a)(1)(B)). The amount of the credit is $0.0001 per gallon of the total gallons of relinquished and transferred annual ground water permit issued after July 1, 1996. The amount of the credit which may be used in any tax year may not exceed 50 percent of that year's tax liability as determined without regard to other credits (O.C.G.A. §48-7-40.11(b). If, after receiving approval for the water conservation credit, the annual permit for water usage from the same ground water source is increased, eligibility to use such credits will expire immediately (O.C.G.A. §48-7-40.11(c)(3)).

Georgia Sales Tax Exemption for Equipment Used for Water Conservation

The state sales tax does not apply to the sale of machinery and equipment which is incorporated into any qualified water conservation facility used for water conservation purposes (O.C.G.A. §48-8-3(36.1A). A qualified water conservation facility is any facility and machinery or equipment used in the water conservation process that results in a permit reduction of at least ten percent either by relinquishment of the transfer of the annual water usage permitted from existing ground water sources due to increased manufacturing process efficiencies or recycling of manufacturing process water, or transfer of the annual permitted water usage from any existing permitted ground water sources to a surface water source or an alternate source (O.C.G.A. §48-8-3(36.1)(B)(ii)). Any such facility must be certified by the Department of Natural Resources as necessary to promote its ground water management efforts for areas with a multi-year record of consumption at, near, or above sustainable use signaled by declines in ground water pressure, threats of salt-water intrusion, need to develop alternative sources to accommodate economic growth and development, or any other indication of growing inadequacy of the existing resource (O.C.G.A. §48-8-3(36.1)(B)(i)). State sales tax will only be waived on the sale of machinery and equipment incorporated into qualified water conservation facilities if the purchaser furnishes the seller with a certificate issued by the tax commissioner certifying that the purchaser is entitled to buy the machinery and equipment without paying the tax (O.C.G.A. §48-8-3(36.1)(C)).

Revenue Bond Law

Under Georgia law, local governments have the authority to issue revenue bonds to finance, in whole or in part, the cost of acquisition, construction, reconstruction, improvement, or extension of any undertaking (OCGA 36-82-62(a)(3)(A)). The term, undertaking, includes any systems, plants, works, instrumentalities, and properties used or useful in connection with the conservation of water for public and private use (OCGA 36-82-61(4)(C)(i)).

Georgia Rules and Regulations

Rules and regulations are developed to govern organizational procedures to be followed in the administration and enforcement of Georgia's statutes. Rules and regulations relating to water resources are generally adopted by the Board of Natural Resources, although the boards of other agencies with water-related responsibilities may also adopt appropriate rules.

Water Conservation Plans

Permit applications for new or additional surface or ground water withdrawals must include a water conservation plan. Water conservation plans for non-farm uses must include information regarding system management, treatment management and other components (DNR Rules 391-3-6-.07(4)(b)(8); DNR Rules 391-3-2-.04(11)).

System management information: For overall system management, the applicant is required to submit the following information:

- A minimum of twelve consecutive months (within the past 24 months) of data concerning unaccounted for water, defined as the difference between the total amount of water pumped into the water system from the source(s) and the amount of metered water use by the customers of the water system expressed as a percentage of the total water pumped into the system.

- A description of any current or planned programs to reduce unaccounted for water such as:

    - Leak detection and elimination;

    - Availability of accurate maps of the water system;

    - Meter maintenance, testing, replacement, calibration, etc;

    - Prevention of tank overflows;

    - Flushing programs without degradation of water quality;

    - Prevention of unauthorized water use – fire hydrants, fire lines, etc;

- A list of unmetered service connections including publicly owned facilities, churches, etc.; or

- Other.

- A list of inter-connections with other water systems and a description of any contractual agreements, type (emergency back-up, wholesale sale or purchase) and purchase amounts.

- Any additional current or planned activities pertaining to system management that will contribute to water conservation. (DNR Rules 391-3-6-.07(b)(8)(i) and 391-3-2-.04(11)(a)).

Treatment plant management information: The applicant is also required to provide the following information regarding treatment plant management:

- The condition, calibration frequency, type, etc. of raw and finished water metering;

- An analysis of in-plant water use for filter backwashing, overflows, and laboratory use as a percentage of total plan production. Also, the plan must outline any ongoing or planned plant improvements (including schedules for planned improvements) and/or revised operational procedures to reduce in-plant use (DNR Rules 391-3-6-.07(b)(8)(ii) and 391-3-2-.04(11)(b)).

- For ground water withdrawals, a description of any recycling or reuse of filter backwash water must also be included (DNR Rules 391-3-2-.04(11)(b)(3)).

Other information: The permit applicant must also submit:

- Information regarding and a general description of the entity's rate making policies including:

  - A list of non-billed service connections. Also, if available, a breakdown by number of meters or percent total production for each class of customer, e.g., residential, commercial, industrial, wholesale;

  - A copy of the water rate structure currently in use, including any surcharges, demand charges, etc., which may apply to certain customers and a description of the effects of this rate structure on water conservation;

  - A description of any system policies concerning second meters for landscaping irrigation and any use of sewer meters for billing; and

  - Statements responding to the following questions: 1) is the system self-supporting and 2) are the water system expenditures subsidized by non-

water/sewer system revenues (DNR Rules 391-3-6-.07(b)(8)(iii) and 391-3-2-.04(11)(c)).

- A description of the plumbing ordinances and codes under which the applicant functions. This section requires a description of the codes to ensure compliance with the ultra-low flow plumbing fixtures and any special requirements for outdoor water use (DNR Rules 391-3-6-.07(b)(8)(iv) and 391-3-2-.04(11)(e)).

- A description of any recycling or reuse of treated wastewater (DNR Rules 391-3-6-.07(b)(8)(vi) and 391-3-2-.04(11)(f)).

- A description of current or planned education programs designed to promote water conservation (DNR Rules 391-3-6-.07(b)(8)(vi) and 391-3-2-.04(11)(g)).

After a water withdrawal permit is granted, the grantee must continue to submit a variety of information regarding water conservation to EPD, including:

- A five year progress report that outlines actions and/or improvements made to conserve water and reduce water loss (DNR Rules 391-3-6-.07(b)(8)(vii) and 391-3-2-.04(11)(h));

- An annual water use data report describing unaccounted for water for the past 12 months (DNR Rules 391-3-6-.07(4)(b)(8)(viii) and 391-3-2-.04(11)(i));

- An annual report describing monthly average and maximum daily use for each month of the previous calendar year (DNR Rules 391-3-6-.07(15)); and

- A description of any additional water conservation activities (other than those described in the permit application) (DNR Rules 391-3-6-.07(b)(8)(x) and 391-3-2-.04(11)(k)).

Permittees are required to incorporate water conservation into long-range planning. This effort involves projecting water demand over a 20 year time period (using methods approved by EPD) and incorporating the effects (or demand reductions) inherent in the implementation of new or enhanced water conservation programs (DNR Rules 391-3-6-.07(b)(8)(ix) and 391-3-2-.04(11)(j)).

Applicants for a permit to operate a public water system may also need to provide information on water conservation plans upon request from EPD (DNR Rules 391-3-5-.17(3)).

Outdoor Watering Schedule

In May, 2004, the Board of Natural Resources adopted a drought management plan that contained significant “pre-drought strategies.” These pre-drought strategies describe water conservation efforts and establish an outdoor watering schedule to be adopted by all water withdrawers and all drinking water providers. Specifically, the outdoor watering schedule applies to water withdrawals throughout the state and establishes a three-

day/week limit for outdoor watering (focused on commercial, industrial, and residential users) (DNR Rules 391-3-30).

Water Reclamation and Urban Water Reuse

In Georgia, urban water reuse is a term generally applied to the use of reclaimed water for the beneficial irrigation of areas that are intended to be accessible to the public, such as golf courses, residential and commercial landscaping, parks, athletic fields, roadway medians, etc. Expanded uses for reclaimed water may also include fire protection, aesthetic purposes (landscape impoundments and fountains), industrial uses, and some agricultural irrigation. Reclaimed water is defined as "domestic wastewater or a combination of domestic and industrial wastewater that has been treated to stringent effluent limitations." Wastewater treated to urban water reuse standards may be used in lieu of potable water for agricultural irrigation, residential/commercial landscape irrigation, dust control, etc. The Environmental Protection Division encourages the use of reclaimed water as a substitute for potable water for these purposes. However, non-irrigation uses are outside the scope of the current guidelines EPD has drawn up to aid municipal wastewater plants that wish to set up a reuse program. Additionally, the Georgia Plumbing Code currently prohibits the use of reclaimed water in buildings (for toilet flushing, etc.).

Owners of reclaimed water treatment systems must obtain a Land Application System (LAS) permit from EPD (DNR Rules 391-3-6-.11(5)). User agreements are required between reuse water users and the wastewater facility. Prior to providing reuse water to a designated user, written notice must be provided to EPD and a public notice must be provided to the community. Any site or facility which wishes to use reclaimed water must enter into a written user agreement with the permittee. The permitee/owner of the wastewater treatment system is responsible for insuring that the reuse water meets the requirements of reclaimed water at the point and time of delivery to the designated user. Reclaimed water must meet strict turbidity, fecal coliform, and biological oxidation standards set by EPD, and any failure to meet these standards results in an automatic rejection or diversion to an alternate disposal site.

Governmental and Nongovernmental Organizations

To determine water conservation programs and activities currently operating in Georgia, a survey was sent by EPD to state agencies, university system units, regional initiatives, and nongovernmental organizations in the state. A copy of the survey is provided in Appendix B. Summaries of current water conservation initiatives were provided by the agencies and organizations. The list of institutions asked to respond to the survey is by no means exhaustive, nor did all the institutions contacted respond to the survey. Additionally, the survey did not attempt to capture local initiatives. It does, however, provide insight into the types of water conservation efforts that currently exist in Georgia.

Governmental Agencies

A number of state agencies are involved in water conservation activities.

Georgia Department of Community Affairs

The Georgia Department of Community Affairs (DCA) serves primarily to provide technical assistance to local governments and the public and to integrate the importance of sound environmental management with the overall health and development of communities. DCA provides technical assistance, supports education and outreach, and advocates for water conservation through a variety of projects and policies:

- The Engineered Soils Demonstration Project demonstrates and measures the benefits of using compost and engineered soils to conserve water.

- In the Every Drop Counts program, public water conservation education materials are provided to local governments in pamphlet and utility bill insert form.

- The WellCare Program is a model program for communities using private wells as their primary drinking water supply. The model program establishes a role for local governments to monitor water use which includes the adoption of a model water conservation ordinance.

- The Model Water Conservation Ordinance is available for local governments to adopt.

- The Water Resources Toolkit is provided to local government officials. The toolkit includes a wide array of water conservation educational materials and local government case studies.

- The WaterFirst program is a local government recognition program for communities exceeding minimum water protection requirements, including water conservation efforts.

- The Children's WaterFestival includes a day-long certification training workshop for Educators teaching Fourth grade students in Georgia. The festival targets a particular river basin in the state, attracts approximately 1500 Fourth graders each year and includes hands-on water stewardship workshops, including water conservation.

One-on-one technical assistance is also provided to communities as requested.

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Georgia Department of Natural Resources

In 1994, the Board of Natural Resources adopted rules to comply with a federal mandate requiring municipalities to implement new, more efficient, federal energy standards, which included water-conserving plumbing codes. Another 1994 amendment to the

Georgia rules and regulations required that a water conservation plan accompany any application for a new or expanded water withdrawal. In 2001, the Board adopted a series of policies, the Water Issues White Paper that included recommendations that the state should, "facilitate the integration of water conservation into all water resource planning initiatives…." In March, 2003, the Board approved a Drought Management Plan that included several pre-drought mitigation strategies designed to minimize the potential effect of drought. These strategies included a statewide outdoor watering schedule that requires communities to water no more than three days per week during non-drought periods.

In 2001, the Georgia Department of Natural Resources created a Water Conservation Program. The program's mission was to promote the long-term efficient use of Georgia's water resources throughout the state. In 2004, many aspects of the program were absorbed into the EPD Director's Office.

Coastal Resources Division

The Georgia Coastal Management Program (GCMP), which is administered through the Coastal Resources Division (CRD), provides technical assistance, outreach, and education to local governments and stakeholder groups regarding coastal resources including water. The water management issues that GCMP has historically targeted include water quality and water quantity. Since its inception in 1998, GCMP has provided technical assistance to local government officials, community groups, researchers, and members of the general public. Currently there are no specific water conservation targeted initiatives and no organizational policies regarding water conservation. The CRD administers the Coastal Incentive Grant program each year to the 11 county GCMP service area and research institutions that are conducting coastal related work. Water related issues have been a priority for funding as set by the advisory council. Non-construction water conservation related projects would be eligible for funding through this grant program.

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Environmental Protection Division

EPD has absorbed many program elements of the DNR Water Conservation Program. The agency is pursuing water conservation on three distinct yet closely related fronts:

- Development of conservation-oriented operational and administrative practices within EPD's programs and regulatory system (see section regarding water conservation requirements)

- Development of the state water conservation plan. This multi-faceted plan will set goals for water conservation and provide a framework to help consumers and providers become better stewards of available water supplies. The plan will:

- strengthen educational efforts;
- solidify partnerships for incentive-based initiatives;
- recommend funding options for implementation and monitoring;
- empower Georgia communities with the tools necessary to protect dwindling water supplies; and
- an ongoing process to implement water conservation in all components of water resource management. This element will ensure water resources are used effectively now and protected for the future.

EPD also offers educational material and training related to water conservation. EPD staff trains teachers in *Project WET – CONSERVE*, a program which educates teachers on ways to incorporate water conservation in classroom curriculum, as well as provides written material educating the public about conducting water audits of household water use. Furthermore, EPD is in the process of developing a new water conservation website. The current DNR website, conservewatergeorgia.net, is still active, but it will be revised and incorporated into EPD domain. The new website will target all water use groups interested in planning and policies related to water conservation, and provide valuable resources, facts and references, as well as EPD forms to be completed for new or revised permits. The website is scheduled to be online in the fall of 2005.

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Pollution Prevention & Assistance Division

The Georgia Pollution Prevention & Assistance Division (P^2AD) is a non-regulatory state agency that promotes water efficiency through technical assistance, research, recognition, and education. Conservation is a major component of P^2AD's holistic, environmental management system (EMS) approach to assisting clients.

P^2AD investigates water reduction opportunities when performing on-site technical assistance for its clients (including all sectors of business, universities and government). This assistance has been available since 1993.

P^2AD considers water use in the P^2AD Partnership program that provides technical assistance, recognition, and mentoring opportunities for organizations developing an EMS. P^2AD also supports the UGA Agricultural pollution prevention program that promotes conservation tillage and applied land application research in addition to the holistic, EMS approach that addresses irrigation practices. This program has been operating since 1995. P^2AD also provides support for water conservation-oriented programs like: EarthCraft House, Leadership in Energy and Environmental Design, and Georgia Green Hotels.

In 2003, P^2AD conducted focus group research and published a survey titled, "Understanding the Public's Perception of Water Issues and the Motivational Messages to Which They Will Respond," that asked questions regarding water conservation (results are available on website). In terms of education and outreach, P^2AD has promoted the "Water-Use It Wisely" campaign since 2004, and provides the factsheet "Water Conservation at Home." Staff members also serve on the Waterwise Council and participate with the Atlanta Regional Commission and Georgia Water and Pollution Control Association on a variety of outreach efforts.

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Georgia Environmental Facilities Authority

Georgia Environmental Facilities Authority (GEFA) provides low-interest financing for water and sewer infrastructure and stormwater management projects. While GEFA currently does not administer any specific water conservation initiatives, they have adopted several program policies related to water conservation. Policy 18 of the 2005 Clean Water State Revolving Fund Loan program, Policy 19 of the 2005 Drinking Water State Revolving Fund program, and Policy 18 of the Georgia Fund Water and Sewer Loan program state that in order to be eligible for a GEFA-[CWSRF, DWSRF, or Georgia Fund] loan, applicants receiving commitments after April 1, 1992, are required to submit copies and proof of adoption of local construction codes which mandate the use of certain water saving devices as outlined in O.C.G.A. §8-2-1 to 8-2-3.

GEFA loans are for a variety of infrastructural improvements many of which involve installing water meters. In addition, through the use of federal set-aside funds, GEFA provides technical assistance to local governments through a contractor (Georgia Rural Water Association) that address water system's problems, such as leak detection. Further, GEFA supports DCA's WaterFirst program, which encompasses water conservation criteria.

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Georgia Soil and Water Conservation Commission

The Agricultural Water Conservation Division of the Georgia Soil and Water Conservation Commission (SWCC) promotes and assists Georgia's agriculture sector in adapting new and improving existing water conservation practices. The agency participates in advocacy efforts, provides education and outreach efforts, provides funding/financial support, conducts research and planning efforts, and provides technical assistance to those involved in agricultural practices.

SWCC's water conservation efforts include:

- Mobile Irrigation Lab (MIL): The MIL program tests the uniformity of center pivot irrigation systems.

- Agricultural Water Metering: This action functions to create a better understanding of the amount of water used by agriculture.

- Irrigator Pro Irrigation Scheduling Incentive Program: This program assists the agriculture community in understanding when and how much irrigation water to apply to a growing crop.

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University System of Georgia

Georgia Institute of Technology – School of Civil and Environmental Engineering - Food Processing Technology Division

The Georgia Institute of Technology – School of Civil and Environmental Engineering – Food Processing Technology Division, researches and provides assistance in advanced technology development (disinfection and reuse), stormwater treatment, management and reuse; industrial best management practices for conservation, and technology verification. The Division offers education and outreach initiatives, research and planning, technical assistance and services related to technology verification.

The Food Processing Division works with the poultry processing industry to identify best management practices to reduce water usage. Also specifically related to water conservation, they assist small municipal water treatment systems identifying strategies and projects that would result in cost-effective solutions for addressing water supply decisions during emergency situations.

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Georgia State University, Albany State University and Georgia Southern University - Georgia Water Planning and Policy Center

The Georgia Water Planning and Policy Center (the Center) provides the institutional framework and academic expertise to proactively address the state's water policy issues on a regional basis. The program stresses the use of applied policy sciences through the expertise of faculty from various disciplines in law, economics, public policy and administration, and related decision sciences. Through the use of advocacy; education and outreach; research and planning; and technical assistance the Center addresses the entire spectrum of water policy issues.

In terms of water conservation specifically, the Center has conducted research and published working papers on conservation pricing in municipal water systems and is heavily involved with agricultural water use issues on a number of fronts. In addition to research, staff and faculty make numerous presentations each year to a variety of civic and professional organizations, many of which include some aspect of water conservation. The Center publishes a quarterly magazine, WaterTalk, as well as a website.

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University of Georgia – College of Agricultural and Environmental Sciences

The UGA College of Agriculture and Environmental Sciences (CAES)'s primary role regarding water resource management is to conduct research, educate and provide extension services for citizens of the state. CAES focuses primarily on advocacy; education and outreach; research and planning; and technical assistance to achieve its goals.

CAES provides expert advice and assistance to a variety of water conservation related programs. They work in partnership with other statewide organizations and agencies including, but not limited to, P^2AD, Georgia Turf Association, Friends of the Garden, the Natural Resource and Conservation Service and USEPA. They conduct research related to urban, rural and agricultural water conservation. Examples of programs sponsored by CAES include:

- Water conservation-oriented workshops and training (for urban and rural landscapes);
- Extension and outreach to environmental horticulture professionals and the general public on water conservation issues - Center for Urban Agriculture http://168.29.148.205/www/urbanag/newurbanag//;
- Demonstration areas to showcase water conservation for landscape professionals and homeowners http://168.29.148.205/www/urbanag/resgarden//;
- Xeriscape and Water Conservation training for landscape professionals;
- Evaluate evapotranspiration-controlled irrigation management for home landscapes;
- Turfgrass water conservation best management practices manual and website www.TurfgrassWater.com;
- Project WET training for 4-H agents; and

- A variety of web-based information and technical assistance regarding rainfall, conservation services, best management practices and household conservation. www.ces.uga.edu/ and www.georgiadrought.org .

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University of Georgia - Department of Poultry Science and Georgia Poultry Federation

The Department of Poultry Science in cooperation with the Georgia Poultry Federation and its members has conducted educational programs and provided technical assistance to Georgia poultry processors to minimize water usage. This effort has been coupled with programs in waste minimization and product recovery. The organization focuses on education and outreach, research and planning, and technical assistance related to water conservation.

The Department of Poultry Science in cooperation with the Georgia Poultry Federation has had an ongoing water conservation program for more than two decades. The program has focused on minimizing water usage in Georgia's poultry processing plants. Poultry specialists at the University of Georgia have developed and delivered educational programs to poultry processors. In addition, direct technical assistance in water conservation strategies has been provided on a proactive basis to poultry processing plants.

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University of Georgia - River Basin Center

The UGA River Basin Center provides technical, legal and organizational assistance on issues relating to the intersection of land use and water quality/quantity. The Center's audience is local and state governments and other watershed stakeholders. They offer education and outreach, as well as research and planning assistance to interested parties.

For the past four years, the River Basin Center has created and maintained a library of water conservation resources that is available to and has been used by UGA faculty and students, local governments, state legislators, state agencies and non-governmental organizations. Faculty and staff have served as advisors on statewide water conservation programs and drafted a white paper on water conservation for use by the water and sewer authorities and local governments in the Etowah basin.

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University of Georgia – Carl Vinson Institute of Government

The Carl Vinson Institute of Government provides water-related policy research, technical assistance, and educational services designed primarily for the Georgia General Assembly, state agencies and local governments in Georgia. Through its Environmental Policy Program, the Institute provides public policy reports and guidance documents on a variety of water and related issues. The Institute provides technical and scientific support to the Georgia General Assembly and local government associations. It also provides educational programs for elected and appointed officials in Georgia. The Institute is providing policy support to EPD in developing the state comprehensive water management plan.

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Regional Initiatives

Metropolitan North Georgia Water Planning District

The Metropolitan North Georgia Water Planning District (the District)'s overall goal related to water conservation is the development of and support for implementation of the Metropolitan North Georgia Water Supply and Water Conservation Management Plan. Through education and outreach programs, research, planning and technical assistance, the District promotes water conservation.

Specifically, the District adopted a ten-measure Water Conservation Management Plan that addresses residential, industrial/commercial/institutional, and water system water users. This multi-pronged approach uses education and public awareness in conjunction with mandated conservation rates and other practices including retrofitting of older plumbing fixtures, providing residential and commercial water audits, providing small scale retrofit kits, requiring the standardized International Water Association method of water loss control, requiring multi-unit submetering, requiring rain-sensor shut-off switches on new irrigation systems, and monitoring water use in the District.

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Northwest Georgia Regional Water Resources Partnership

The goals of the Northwest Georgia Regional Water Resources Partnership include serving as an advocacy group for northwest Georgia water resources, completing a watershed analysis for the 15 counties in the region, educating members and citizens on water related issues, and helping to monitor and shape local, regional, state and national policy regarding water related issues. The partnership's water conservation related programs and initiatives include advocacy, education and outreach, offering funding and financial assistance, research and planning, and technical assistance.

After completing the watershed analysis for the 15 counties in northwest Georgia, the partnership will provide assistance to the counties as far as meeting both withdrawal and discharge permitting requirements. A significant part of this process will be educating the leadership and group members on conservation practices and providing assistance to member permit holders and governmental entities.

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Nongovernmental Organizations

A wide variety of nongovernmental organizations are involved in water conservation efforts in the state. They range from professional organizations to advocacy groups to trade associations.

Association of County Commissioners of Georgia

In 1997, ACCG entered into a contractual relationship with the Georgia Environmental Facilities Authority and the Environmental Protection Division to form the Georgia Water Management Campaign to enhance local governments' ability to manage and protect water resources. A wealth of informational materials/tools were produced, providing local government officials with an overview of water management practices in Georgia and issues that would impact future management endeavors during the five years of the Campaign's existence.

In 2002, building upon the successful Water Management Campaign, ACCG partnered with the Department of Community Affairs and the Georgia Municipal Association to produce Tools for Protecting Georgia's Water Resources, a two-CD tool kit. The CDs, *Water Resources: A Toolkit for Local Governments and Watersheds of Georgia*, provide a wealth of comprehensive information on water resource management, including an entire chapter on water conservation.

In 2004, having received much positive feedback on the above CD set, ACCG worked with DCA, the Conference of Southern County Associations and the USEPA Region 4 to produce a 4-CD tool kit entitled Water Stewardship Tools for Local Governments. This CD set, made for local governments in the eight-state southeastern region (USEPA Region 4), provides an entire section on water conservation which includes information on conservation pricing, using water efficiently, conservation plan guidelines, and tips for drought conditions. Water conservation practices are also broken down by state.

ACCG's 2005 Policy Platform, formulated by county commissioners to express the organization's position on issues of significance to local governments, addresses myriad water management and conservation issues. Positions taken encourage the use of reclaimed water for irrigation and other nonpotable uses; encourage local governments to collect data and implement policies, programs, and practices which promote water conservation; request that the General Assembly fund research necessary to achieve the

effective management of water resources throughout Georgia; and applaud DCA's WaterFirst program.

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Georgia Agribusiness Council

The Georgia Agribusiness Council (GAC) promotes efficient water use in all areas of agriculture, from production to processing. GAC works with numerous commodity associations and state agencies to promote and coordinate opportunities for studying agricultural water use and implementing technology to achieve improved efficiencies. GAC uses advocacy, education and outreach, and state legislative and budget support to achieve these goals.

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Georgia Agricultural Commodity Commission for Peanuts

The Georgia Agricultural Commodity Commission for Peanuts reviews water issues and policy initiatives as they impact peanut production and producers who grow peanuts and make suggestions to policy makers. They also work to educate farmers on conservation-related issues. The Commission funds irrigation research aimed at the effective timing and quantity of irrigation water application, and uses advocacy, research and planning to achieve its goals.

The Commission's primary water conservation efforts center around research activities targeted at the effective and timely application of proper quantities of irrigation waters. The commission funds research conducted at the University of Georgia.

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Georgia Association of Water Professionals (Formerly GW&PCA)

The Georgia Association of Water Professionals (GAWP) is dedicated to education, dissemination of technical and scientific information, increased public understanding, and promotion of sound public laws and programs in the water resources and related environmental fields. It participates in advocacy work as well as education and outreach.

GAWP strongly encourages water utilities to adopt policies and procedures that result in the efficient use of water, in their operations and by the public, through a balanced approach combining demand management and phased source development. To this end, GAWP supports the following water conservation principles and practices:

- Efficient utilization of sources of supply;
- Appropriate facility rehabilitation or replacement;
- Leak detection and repair;
- Accurate monitoring of consumption and billing based on metered usage;
- Full cost pricing;
- Establishment of water-use-efficiency standards for new plumbing fixtures and appliances and the encouragement of conversion of existing high-water-use plumbing fixtures to more efficient designs;
- Encouragement of the use of efficient irrigation systems and landscape materials;
- Development and use of educational materials on water conservation;
- Public information programs promoting efficient practices and water conservation by all customers;
- Integrated resource planning;
- Water reuse for appropriate uses; and
- Continued research on efficient water use practices.

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Georgia Chapter of the American Water Resources Association

The Georgia Chapter of the American Water Resources Association (GAWRA)'s overall role regarding water management is to advance multidisciplinary water resources education, management and research. GAWRA focuses specifically on provided technical assistance for:

- The advancement of water resources research, planning, development, management and education;
- The establishment of a common meeting ground for physical, biological, and social scientists, engineers, and other persons concerned with water resources; and
- The collection, organization, and dissemination of ideas and information in the field of water resources science and technology.

The American Water Resources Association has a wide range of members and interests, including water conservation. AWRA supports many technical committees. Those most closely related to water conservation include aquifer storage and recovery, and hydrology and watershed management committees. It also offers periodic journal articles related to water conservation.

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Georgia Conservancy

On the state and local level, the Georgia Conservancy takes an active role through projects, initiatives, and commitments to educate on and advocate for three main principles: 1) every Georgian has the right to a clean and adequate water supply; 2) Georgia's surface and ground water is a public resource that must be managed and allocated by public institutions; and 3) every Georgian should practice good stewardship and champion the protection of our state's unique aquatic resources. Its two main water initiatives are the statewide planning process and the Georgia Water Coalition. The Conservancy plays an active role in advocacy, education and outreach, and research and planning.

The Georgia Conservancy adopted an organizational policy regarding water conservation in 2000 that states, "Reducing demand on surface and ground water supplies through conservation programs should be considered equally with other means of meeting our water needs, because it best preserves the delicate ecological balance." The Georgia Conservancy completed a report in 2004 that describes seven essential components derived from examining 14 U.S. water conservation programs. The Conservancy's educational initiatives also promote water conservation.

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Georgia Environmental Council

The Georgia Environmental Council (GEC)'s mission is to provide information on issues of interest to member organizations and opportunities to exchange views with officials that make and implement policy. Regarding water conservation, the GEC focuses on education and outreach and participates in the Georgia Water Coalition efforts through communications support.

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Georgia Farm Bureau

The Georgia Farm Bureau advocates for the rights of farmers and landowners to use water. It also supports water conservation initiatives that assist farmers in using water more efficiently and lobby for funding of such projects. The Georgia Farm Bureau focuses primarily on advocacy, education and outreach to meet the organization's goals. The Bureau supports state and federal funding for the conservation of water through the construction of water reservoirs, ponds, and other impoundments. The GFB also supports efforts to measure the amount of water used for agriculture provided the state pays for the costs of the program. It supports state and federal funding to improve irrigation efficiency, and supports the Georgia Soil and Water Conservation Commission's mobile irrigation lab program.

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Georgia Golf Course Superintendents Association

The Georgia Golf Course Superintendents Association (GGCSA) is the lead organization for Water Conservation and Management in the Allied Golf Group (Georgia State Golf Association, Georgia PGA, Georgia Club Managers Association, the Georgia Golf Course Owners Association, and the Georgia Golf Course Superintendents Association) supplying programs to all members and golf courses. The association's 501(c)(3) sister organization, Georgia Golf Environmental Foundation, is a funding mechanism for water management research and education.

The association provides education and outreach, funding/financial assistance, research and planning, and technical assistance to all its members. It also provides a collection of best management practices for water conservation on golf courses. Specifically related to water conservation and reuse, GGSCA provides:

- An information booklet on environmental and economic issues surrounding water and golf entitled, "Georgia Golf - Keeping Georgia Green";
- The GGCSA Re-Use Water Handbook helps golf course managers understand the State Guidelines and how to manage re-use water;
- Seminars on best management practices for water conservation;
- Articles in various trade magazines and golfer magazines such as *Golf Georgia*;
- Information sharing with other states and National Golf Organizations;
- Ongoing Georgia Golf Environmental Foundation (501(c)(3) sister organization) supports best management practices education and materials;

- Financial support of "H2-Uh OH!" a Channel 2 special on Outdoor Watering Rules;

- Legislative advocacy for recognition of proper water management by golf course superintendents; and

- Continuing education on water conservation and reclaimed water.

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Georgia Municipal Association

The Georgia Municipal Association (GMA) provides opportunities for formal training on utility operation/management, offers sessions on water policies, legislative discussions, and the practical aspects of water resource management throughout the year. GMA supports water conservation and other related topics.

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Georgia Public Policy Foundation

The Georgia Public Policy Foundation's overall role in water management issues is to advocate for market-oriented public policy. Since its creation 14 years ago, the Foundation has promoted market-oriented approaches to public policy, including water quality and quantity policy including such cost-effective practices as:

- better pricing of water to encourage conservation;

- user fees to pay for source-water protection;

- cost-based user fees to fund watershed protection;

- municipal stormwater utilities;

- a statewide Watershed Management Trust Fund;

- opportunities for industry and farmers to trade for water quality improvements similar to the current air trading program;

- educating developers and facilitating adoption of conservation-minded water practices; and

- a market-based trading system for allocating water use.

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Georgia River Network

The Georgia River Network (GRN)'s overall goal is to engage citizens and watershed groups in planning processes to protect Georgia's rivers and streams. They advocate for a comprehensive statewide plan that will protect and restore the health of Georgia's rivers. GRN uses education and outreach, as well as advocacy to advance their goals.

Regarding water conservation, GRN advocates for the state to aggressively implement water conservation programs to reduce the demand for water prior to increasing supplies. GRN also advocates for state agencies and facilities to implement water conservation plans and serve as models for conservation and efficient use of water. Additionally, it advocates for a comprehensive water management plan that includes enforcement provisions for permits that require permittees to record use and forbids the issuance of new permits or modifications of current permits until impact on water resources is known and a water conservation program is implemented. It provides citizens with information on conservation practices through its website and other outreach activities.

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Georgia Water Coalition

The Georgia Water Coalition (GWC) is comprised of 121 businesses and recreational, civic, faith-based, and conservation groups throughout the state. GWCs primary goal is to preserve and protect the quantity and quality of Georgia's waters for the benefit of all Georgians. GWC works through advocacy, education, and outreach to promote a state water management plan based on these four principles:

- That the surface and ground waters of the state continue to be a public resource managed in the public interest and in a sustainable manner by the state to protect natural systems and meet human and economic needs;

- That water management must be guided by a comprehensive state water management plan, developed by a lead agency with a dedicated planning staff, in coordination with other agencies and with the participation of all interested citizens;

- That effective water management requires regional water planning, based on watersheds, river basins and aquifers, that is tied to implementation including an adaptive management process; and

- That regulation of interbasin transfers must be strengthened to reflect scientific knowledge, respect natural systems and protect the basins of origin and receipt.

Regarding water conservation, the GWC advocates for a statewide plan that:

- Aggressively manages the demand for water before increasing water supplies. In all water supply plans, water conservation programs should be aggressively implemented to reduce the demand for water prior to increasing supplies. A state water plan should also ensure that state agencies and facilities implement water conservation plans and serve as models for conservation and efficient use of water.

- Maximizes conservation using water withdrawal permit requirements. Conservation plans should be included as enforceable provisions of new, renewed, or expanded permits. All permitted users should be required to maintain a standardized record of their use of surface and ground water. No new permits or any modification of existing permits should be issued until the impact on the resource is known and the applicant has implemented a conservation program. Revocable portions of existing permits should be reviewed and modified to achieve conservation of the resource.

GWC also publishes educational material related to water conservation and helps train members of the importance of water conservation.

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Georgia Water Wise Council

The Georgia Water Wise Council (GWWC) promotes water conservation and water quality programs in Georgia through a consortium of governments, educational facilities, businesses, and citizens. GWWC focuses primarily on education and outreach programs and initiatives.

The Council has several current initiatives designed to promote and provide statewide public awareness of the value of sound water management practices to enhance water conservation and water quality. It provides educational curriculum material on water for K-12 schools in hardcopy or CD-ROM format called "The Water Source Books." The Council is currently developing a series of eight brochures on water conserving and preserving landscape management and revising the Xeriscape Manual which was disseminated by the GWWC in the past. GWWC has a website with information resources on water conservation and a Speakers Bureau. The Council sponsors a demonstration Xeriscape garden at the Bamboo Gardens in Savannah, Georgia. GWWC also sponsors awards and scholarships for 4-H projects that deal with water resources and environmental quality. It sponsors an annual award for landscape professionals through the Georgia Green Industry Association for water wise landscape designs.

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Georgia Wildlife Federation

The Georgia Wildlife Federation (GWF) is a co-founder of the Georgia Water Coalition, and advocates for a water management plan based on the four principles of the Coalition, as well as the Coalition's positions on water conservation (see entry on Georgia Water Coalition). GWF supports many education and outreach programs. It strongly emphasizes the use of native plants because they are hardier and easier to maintain than ornamental hybrids and they conserve water and provide better habitat for native wildlife. The GWF's education programs teach about native plants particularly because they do not require the constant watering, fertilizing, and spraying of pesticides that exotics require. These programs also educate others about the importance of mulch and compost, which cuts down on watering and weeding.

GWF provides some financial support for water-related issues. In 2005, it provided financial support to the Georgia River Network and the Conservation Research Institute to host a series of local water messaging workshops around the state. Issues of focus included ways to conserve water and what the state can do to ensure that conservation and reuse are considered first when looking at management tools.

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Plumbing & Mechanical Association of Georgia

The Plumbing & Mechanical Association of Georgia (PMA) is composed of plumbing contractors who install and service plumbing fixtures in residential and commercial applications. The association participates in advocacy activities and offers technical assistance to members.

PMA has expertise available on low flow fixtures, sub-metering of multi-family buildings, submetering of fixtures, control of water loss through leak detection, and retrofit rebate programs.

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Savannah Riverkeeper

The Savannah Riverkeeper is a non-profit water quality advocacy group. It uses advocacy, education, and outreach to encourage water conservation as it applies to water quality. Specifically, it advocates for water conservation in household water use to reduce

the volume of water to be treated as well as the need for additional treatment, which can become a form of contamination. The group further advocates for minimal use of treated water in irrigation.

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Sierra Club, Georgia Chapter

Georgia Chapter of the Sierra Club plays an active role in water management issues through involvement with the Metropolitan North Georgia Water Planning District, Georgia Water Coalition, Georgia Water Wise Council of Georgia, and the Georgia Water & Pollution Control Association. Georgia Sierra Club also maintains an active role in the Georgia legislative process.

The Sierra Club has advocated water conservation through a hotel-motel linens reuse project, and also presents water conservation programs to its members and writes about water conservation and successful water conservation programs in its quarterly newspaper. Additional advocacy takes place through the Georgia Water Coalition and through the support of other organization's programs.

The GASC is investigating the feasibility of a home water audit video, to be produced for use state-wide. Schools are being targeted directly and indirectly through support of Georgia Water Wise Council's education activities.

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Southern Alliance for Clean Energy

The Southern Alliance for Clean Energy (SACE) works on energy policy issues in Georgia and throughout the Southeast. SACE addresses the impacts of energy production and use (primarily electricity generation) on the state's water resources in a variety of venues, including regulatory hearings, public education/outreach, meeting with policy makers/elected officials, etc. SACE is a member of the Georgia Water Coalition (GWC), and promotes its positions through advocacy, education and outreach, and research and planning.

SACE has advocated for the adoption of energy efficiency and energy conservation policies that would likely reduce the impacts on our water resources (both water quality and water supply). SACE also researches and advocates for the use of less-water intensive energy supplies, such as most renewable energy resources, that use inherently less water than traditional fossil and nuclear power plants.

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Southface

Southface's overall role regarding water management is to educate consumers and design and construction professionals on water efficient technologies for buildings, and alternative technologies ranging from graywater reuse to stormwater management. Southface focuses on water conservation initiatives related to education and outreach, research and planning, and promoting green building programs that encourage water efficiency and alternative technologies. Water conservation initiatives include:

- EarthCraft House: This residential green building program educates design and construction professionals on a wide range of water issues from watershed protection to efficient plumbing fixtures. The program addresses water at the land development phase, as well as during design, construction and renovation.

- Commercial green building: Working primarily through the Leadership in Energy and Environmental Design green building rating program, Southface offers training and direct technical assistance on green commercial buildings.

- Eco Office and Southface Eco Home: These demonstration buildings showcase a variety of water efficiency practices as well as alternative technologies such as graywater reuse, rainwater harvesting for irrigation and sewage conveyance, composting toilets, and drought tolerant landscape design. The Eco Office is currently under construction and will be completed in spring, 2006.

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The Garden Club of Georgia, Inc.

The Garden Club of Georgia, Inc. (GCG) focuses its efforts on education and outreach about water and other conservation issues to its members in 502 garden clubs across Georgia. The GCG is involved in advocacy work through the Georgia Water Coalition and also engages in legislative work with the Georgia Conservation Voters. GCG developed a position paper on Water in 2003, and has its own water program, Forging Leadership in Our Watersheds (FLOW). GCG is also a member group of the Georgia Environmental Council and regularly works in close partnership with other organizations and agencies.

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The Nature Conservancy, Georgia Chapter

The Georgia Chapter of the Nature Conservancy (TNC)'s overall role regarding water management is the protection of aquatic biodiversity. TNC provides opportunities for education and outreach, funding and/or financial assistance and technical assistance to achieve their organization's goals.

Specific to water conservation, TNC, Georgia Chapter has an agricultural water conservation project underway in the lower Flint River basin. The Flint River Program was established one year ago under an agreement with the Flint River Soil and Water Conservation District, and the Natural Resource Conservation Service to promote agricultural water conservation. TNC works directly with farmers to provide financial incentives under the federal Farm Bill, education and outreach about water conservation practices, and technical assistance with implementation of practices. TNC also is involved in regional water supply planning in the upper Etowah River watershed. The Etowah Program promotes water conservation as an important part of water supply development.

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Upper Chattahoochee Riverkeeper

The Upper Chattahoochee Riverkeeper (UCR) advocates for demand management and water conservation and works to achieve these goals with policy and legislative strategy. UCR uses advocacy and education and outreach to promote the goals of the organization.

UCR advocates demand management strategies, most recently in the Metro District Water Supply and Conservation Plan. UCR works at the legislature to promote water conservation and supports water use and efficiency in new planning and policy. Its advocacy goals encompass the scope of water efficiency and demand management as it relates to protecting the watershed for current and future generations while ensuring sustainable communities.

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Water Conservation Initiatives by Organizations

The following chart summarizes the responses of the previously discussed statewide organizations and agencies involved in water resource management. Survey participants were asked to check off the categories that best defined their work related to water conservation. Participants were asked, "Does your organization have a program or initiative related specifically to water conservation?," with the categories below provided.

Water Conservation Activities by Organizations

	Advocacy	Education and outreach	Funding or financial assistance	Research and planning	Technical assistance	Other	
Association County Commissioners of Georgia	X	X		X			
Georgia Agribusiness Council	X	X				X	Legislative and budget support
Georgia Agricultural Commodity Commission for Peanuts	X			X			
Georgia Association of Water Professionals (Formerly GW&PCA)	X	X					
Georgia Chapter of the American Water Resources Association					X		
Georgia Conservancy	X	X		X			
Georgia Department of Community Affairs	X	X			X		
Georgia DNR/Coastal Resources Division					X		
Georgia DNR/Environmental Protection Division		X		X	X		
Georgia Environmental Council		X				X	Communication support
Georgia Environmental Facilities Authority			X				
Georgia Farm Bureau	X	X					
Georgia Golf Course Superintendents Association		X	X	X	X	X	BMPs for Water conservation
Georgia Municipal Association	X	X			X		
Georgia Power Company		X		X		X	
Georgia Public Policy Foundation	X						
Georgia River Network	X	X					
Georgia Rural Water Association		X			X		
Georgia Soil and Water Conservation Commission – Ag Water Conservation Division.	X	X	X	X	X		
Georgia Water Coalition	X	X					

	Advocacy	Education and outreach	Funding or financial assistance	Research and planning	Technical assistance	Other	
Georgia Water Planning and Policy Center	X	X		X	X		
Georgia Water Wise Council		X					
Georgia Wildlife Federation	X	X	X				
Metropolitan North Georgia Water Planning District		X		X	X		
Northwest Georgia Regional Water Resources Partnership	X	X	X	X	X		
Plumbing & Mechanical Assn. of Georgia	X				X		
Savannah Riverkeeper	X	X					
Sierra Club, Georgia Chapter	X	X	X				
Southern Alliance for Clean Energy	X	X		X			
Southface		X		X	X	X	Green Building programs for water and energy efficiency
The Garden Club of Georgia, Inc.	X	X					
The Nature Conservancy		X	X		X		
Trout Unlimited	X	X		X			
UGA College of Agricultural and Environmental Sciences	X	X		X	X		
UGA Department of Poultry Science and Georgia Poultry Federation.		X		X	X		
UGA River Basin Center		X		X			
Upper Chattahoochee Riverkeeper	X	X					

Among the 37 groups that responded to the survey, activities were described as follows: 23 advocacy, 31 education and outreach, 7 funding and financial assistance, 16 research and planning, and 16 technical assistance.

Summary

This brief discussion of water conservation-related laws, rules, policies, and activities currently underway in the state suggests that water conservation is reducing demands we place on our water resources. Most of this information is anecdotal since no overall analysis has been done to determine the full extent and effectiveness of current water conservation activities. At the same time, however, this review suggests that there is a widespread, but generally uncoordinated, effort to inform water providers and users about the importance of water conservation and practices to reduce water use. As we consider policy changes to expand water conservation efforts in Georgia, we should build on these existing policies and activities.

Chapter 3

ANALYSIS AND DISCUSSION OF WATER CONSERVATION OPTIONS

Georgia's abundant water supplies have historically allowed a measure of complacency regarding how much water is used for various purposes. During recent periods of water shortages, balancing the competing demands of domestic, agricultural, industrial, commercial, and other human demands with the needs of natural systems has become an increasingly difficult task. Georgia's Drought Management Plan addressed some aspects of water conservation, but its main focus is on emergency response during times of water shortage. The current discussion focuses on ways that Georgia can manage water resources in a way that minimizes the need for emergency response.

One advantage Georgia has over other states in dealing with water conservation, efficiency, and reuse is that we are not on the cutting edge of developing policies, programs, technologies or other necessary means to create an effective program. Because we have enjoyed a relatively plentiful supply of water, we have not had to struggle with these issues like many other states, particularly those in the West. Consequently, a great deal has been learned about how to effectively conserve water, use it more efficiently, and to reuse it. We can thus benefit from the knowledge gleaned by other states and regions to put in place effective policies and programs in Georgia.

Chapter 3 summarizes guidance offered by water conservation experts, presents useful information offered by recent water conservation research and analysis, describes specific water conservation practices that are commonly employed, and gives specific examples of how other states have implemented selected practices in their state-wide water conservation programs. Appendix A offers a more comprehensive description of the water conservation programs adopted in each of these states.

Guidance for the Development of a Water Conservation Program

A number of studies have been undertaken to determine what factors are important to have a successful water conservation program. Most of these studies have focused on local/regional programs. These programs tend to focus on the needs of local water supply and wastewater facilities, monitoring, water use forecasting, water conservation practices, and the costs and benefits of implementing practices considered. Water supply and conservation planning at the state level sets the stage for these local programs to exist and succeed.

In her 2001 book, *Handbook of Water Use and Conservation*, Vickers identifies 10 key planning steps to a successful water conservation program at the local level, summarized below (Vickers, pp. 2-3). (The term "conservation measure" as used below, is synonymous with "conservation practice" as used elsewhere in the report.)

- **Identify conservation goals**, including specified water use reduction goals and the time frame of the program.

- **Develop a water-use profile and forecast**. Identify existing water supply sources and anticipated future demands, and determine the impact of prior and planned water conservation efforts on demand forecasts.

- **Evaluate planned water supply and wastewater facilities.** Forecast system capacities and projected costs for expanding or building new water supply and wastewater facilities.

- **Identify and evaluate conservation measures**. Develop a matrix of measures in terms of water savings, benefits, costs, and other considerations; assess the extent of use of existing measures; and identify obstacles to the implementation of measures.

- **Identify and assess conservation incentives** that would motivate water users to implement water conservation measures.

- **Analyze benefits and costs**. Estimate the short-term and long-term benefits that can be achieved by each water conservation measure, and determine the cost-effectiveness of measures over the life of the program.

- **Select conservation measures and incentives**. Identify quantitative and qualitative criteria for selecting measures and associated program incentives, and evaluate and rank measures using selection criteria.

- **Prepare and implement the conservation plan**. The plan should include information from the previous analysis and should be approved and endorsed by the public, including elected officials, utility managers, ratepayers, regulators, and business and community leaders.

- **Integrate conservation and supply plans, and modify forecasts**. Modify plans for water supply and wastewater capital facilities, evaluate future water purchases and services and, if appropriate, integrate the conservation plan into an integrated resource plan.

- **Monitor, evaluate and revise programs as needed**. Once implemented, adjust the plan as needed based on findings from monitoring actual water savings, costs and benefits, and water-user participation.

In 1998, USEPA published the *Water Conservation Plan Guidelines* (USEPA 1998). The contents of a comprehensive water conservation plan laid out in the guidelines are very similar to the 10 steps suggested by Vickers.

- Specify conservation planning goals;

- Develop a water system profile;
- Prepare a demand forecast;
- Describe planned facilities;
- Identify water conservation measures;
- Analyze benefits and costs;
- Select conservation measures;
- Integrate resources and modify forecasts; and
- Present implementation and evaluation strategy.

Although both of these documents focus primarily on local and regional water conservation programs, the identified components generally relate to state programs as well, and they must fit into the state policy framework if they are to be useful.

In addition to guidance on water conservation and efficiency, information is available on reuse of reclaimed water. For example, when Florida's wastewater utilities began to implement reuse systems in the late 1980s and 1990s, they were faced with the challenge of creating a market for their reclaimed water. Many customers were skeptical and reluctant to use reclaimed water and, to encourage use, many reclaimed water facilities provided reclaimed water at greatly reduced rates or at no cost. As customer bases grew, these low rates encouraged overuse and waste of reclaimed water, which became a burden for utilities. The need for an attitude shift about reclaimed water became apparent, and several public forums in 2001 and 2002 focused on how to ensure that reclaimed water is used efficiently and effectively. Committee and workgroup efforts produced *Water Reuse for Florida: Strategies for Effective Use of Reclaimed Water*. (See the Florida summary in Appendix A for additional information about the report.) A key component of the report is a list of sixteen strategies for "viewing reclaimed water as a valuable resource" recommended for use in Florida:

- Encourage metering and volume-based rate structures;
- Implement viable funding programs;
- Facilitate seasonal reclaimed water storage (including aquifer storage and recovery);
- Encourage the use of reclaimed water in lieu of other water resources in the agricultural irrigation, landscape irrigation, industrial/commercial/ institutional, and indoor water use sectors;

- Link reuse to regional water supply planning (including integrated water resource planning);
- Develop integrated water education programs;
- Encourage ground water recharge and indirect potable reuse;
- Discourage effluent disposal;
- Provide water use permitting incentives for utilities that implement reuse programs;
- Encourage reuse in Southeast Florida;
- Encourage the use of supplemental water supplies;
- Encourage efficient irrigation practices;
- Encourage reuse system interconnects;
- Enable redirecting of existing reuse systems to more desirable reuse options;
- Use reclaimed water at government facilities; and
- Ensure continued safety of water reuse.

The report also identifies topics that should be considered for legislative action and rulemaking changes. These include the creation of funding programs; encouragement of metering reclaimed water and volume-based rates for reclaimed water use; added emphasis on reuse in regional water supply planning; consumptive use permitting incentives; mandated use of reclaimed water at state facilities; and longer permit durations for reuse programs.

Guidance with a greater focus on statewide water conservation planning is provided by a 2004 paper published by the American Water Works Association, “Critical Components of Water Conservation Programs” (Keyes et al.). The authors identified water conservation programs that had received recognition from water conservation experts and federal agencies for meeting water supply and/or conservation goals, and researched each recommended program. Thirteen programs emerged as water conservation leaders: the states of Arizona, California, Florida, Maryland, Massachusetts, New Hampshire, New Mexico, North Carolina, and Oregon, and local and regional programs in Albuquerque, New Mexico; Cary, North Carolina; Irvine Ranch Water District, California; and Phoenix, Arizona. After interviewing agency and local officials responsible for program implementation as well as scientists and nongovernmental organization members, the

authors were able to describe the following seven "keystone" components of successful water conservation programs:

- Political leadership;
- Stakeholder involvement in planning and implementation;
- Detailed policy outlining goals and conservation practices;
- Detailed water use data, forecasting and monitoring;
- Stable funding sources for water conservation initiatives;
- Sufficient staff and technical assistance; and
- Broad-based water conservation education and outreach.

The authors stress that individually, each component can get results, but that the components are not exclusive. Although few programs actually include all seven components, the most reliable results are obtained by the integration of all components. (Keyes et al.) Since water efficiency depends heavily on new technologies and practices, education and technical assistance programs are important to inform people about improved water efficiency. Where technology is concerned, some of this is accomplished through advertising of products by the manufacturers. However, as with conservation, there is generally a need to provide unbiased analyses and advice to the public. In some cases, as with the replacement of old, inefficient toilets with newer ones designed to use less water, financial assistance may be necessary. Examples of how such a program might work are available and can show that much can be accomplished while being revenue neutral.

In 1998, USEPA published a document as part of its Water Conservation Plan Guidelines, *State Role in Water Conservation Planning* (USEPA 1998). The activities identified by USEPA for states to achieve successful water conservation are as follows:

- Clarify state water conservation goals;
- Specify the role of water conservation in state revolving funds programs;
- Determine eligibility for public funding for water conservation;
- Identify which water systems are expected to file water conservation plans and at what level;
- Decide what elements are mandatory and under what conditions;
- Provide state guidance manuals and technical assistance;

- Provide state-specific benchmarks and standards; and

- Review water rights laws and other disincentives to water conservation.

These activities relate primarily to the interaction of EPD and the Georgia Environmental Facilities Authority (GEFA) with local governments and water providers under the requirements of the federal Safe Drinking Water Act. Overall state policy relating to water conservation, efficiency, and reuse are broader than this and require consideration of some other policy options. For this reason, it is instructive to review the conservation programs adopted by other states.

How Other States Have Implemented Water Conservation Policy Components

The two analyses that deal specifically with state conservation programs (Keyes et al. 2004 and USEPA 1998) have some recommendations in common: the need for goals, adequate funding, and technical guidance/assistance. The fact that other components do not appear on both lists of recommendations does not lessen their importance, but reflects the focus, methods, and purpose of each of these analyses. It is useful to view the components of both documents in entirety and then examine how other states have incorporated these elements in their water conservation programs:

- Goals, benchmarks, and standards;

- Funding sources and mechanisms (and related incentives);

- Guidance and technical assistance;

- Political leadership;

- Stakeholder involvement;

- Water use data collection and forecasting;

- Decision regarding the level at which conservation plans are required;

- Consideration of disincentives to water conservation; and

- Mandatory versus voluntary conservation.

Many western states have long recognized the need for year-round, long-term conservation programs as a critical aspect to protecting water resources. Several eastern states have also developed significant water conservation programs. It behooves us to take note of these states' experiences in making decisions about the potential development of a statewide conservation program in Georgia.

In order to examine elements of successful programs and to compile a comprehensive inventory of policy options and assess the possible usefulness of various options, we researched 14 states identified to have statewide water conservation programs in place: Arizona, California, Colorado, Florida, Massachusetts, Maryland, Nevada, New Jersey, New Hampshire, New Mexico, North Carolina, Oregon, Texas, and Washington. Of these states, six (Arizona, California, Florida, Massachusetts, North Carolina, and Texas) were chosen, based on conservation experience and geographic and program variety, for detailed analysis of statewide agencies and organizations, statutes, rules, and programs related to water conservation. Detailed summaries of state water conservation policies and programs can be found in Appendix A, where references for state information are provided.

Goals, Benchmarks, and Standards

Goals, benchmarks, and standards, as well as an implementation schedule for meeting goals, are critical aspects of water conservation and efficiency programs. Goals established by water conservation programs are commonly found in a general statement of policy (often in state or regional water supply plans) or are quantifiable, such as daily per-capita-use goals. Each state surveyed for this report offers examples of each type of goal. Texas, in its state water plan, states, “The state water plan shall provide for the orderly development, management, and conservation of water resources and preparation for and response to drought conditions, in order that sufficient water will be available at a reasonable cost to ensure public health, safety, and welfare; further economic development; and protect the agricultural and natural resources of the entire state.” Texas also requires specific and quantifiable goal-setting: ground water management districts must establish quantifiable management objectives, along with performance standards for each practice. Goals can be established in a graduated manner, as in Arizona’s active management areas, which are required to implement progressively more stringent conservation practices over a 45-year period. Goals can also be targeted to areas that have more serious water supply problems. In Arizona, these are active management areas; in North Carolina, it is the Central Coastal Plain Capacity Use Area; in Florida, they are water resource caution areas. Massachusetts, with a tiered designation of basin stress levels, accomplishes the same goal of implementing conservation practices where they are needed most.

Another consideration concerning goals is whether they are established by and for the entire state or are determined on a local level. Some states require the establishment of goals at the local level, but allow local governments or utilities to set those goals. Texas, for example, requires holders of water rights above specified quantities to develop plans that include specified 5- and 10-year targets for water conservation. Some states also require specific water users to meet certain goals: North Carolina established a goal for state agencies to reduce water consumption by 10 percent.

Funding Sources

Conservation programs tend to rely on a variety of funding sources, but according to Keyes et al., successful local and state level conservation programs around the U.S. cite statewide funding as a source of their success. Many water conservation programs are implemented by water utilities, yet facilities often do not charge enough for water provision to cover these expenses. Funding sources are important because water conservation and efficiency programs rely on public information campaigns and technical assistance (which require funding for staffing as well as materials and service costs such as radio time) plumbing fixture rebate and retrofit offers, financial incentives, and other capital-outlay projects that require direct financial expenditures to water users or utilities.

Florida's water management districts are in an enviable position to be authorized to levy property taxes to fund water conservation programs as well as other water management activities. Most states rely on a variety of creative funding alternatives to provide grants and/or loans, and most states also expect water utilities to absorb much of the cost of water conservation programs because ultimately, those programs save utilities the expense of adding infrastructure and finding alternative water supplies to meet additional water demands.

An important consideration for funding is whether to include financial incentives for water conservation efforts. Some states, such as Texas, allow local authorities to grant property tax exemptions if selected water conservation practices are implemented. Texas also requires that before the Water Development Board grants funding to a water supply project, the applicant must adopt conservation practices.

Guidance and Technical Assistance

Virtually all water conservation efforts depend on public awareness of the need for conservation. Many conservation initiatives, especially those with technical components, such as those targeted for landscape and agricultural irrigation and commercial and industrial water use, rely on the collection and dissemination of use-specific information. Without adequate knowledge, water users lack the ability to put conservation practices into place, however motivated they may be. Investments in public and targeted education have high water conservation returns, and public awareness tends to build political support and participation. Florida implemented a public information campaign for water reuse along with statutory encouragement and requirements, and the state has become a national leader in water reclamation and reuse. Many local programs, such as in Cary, North Carolina, focus on school programs to educate the public about conservation benefits.

A valuable mechanism that is used for technical assistance in Florida and California is the Mobile Irrigation Lab, which generally consists of one or two water efficiency professionals, a vehicle, and specialized equipment. Teams travel to specified areas, most often to agricultural irrigators, to offer water use audits and recommendations for ways to

improve water use efficiency, either through management changes or technical improvements. Many states require state agencies to provide guidance documents and technical assistance to local governments and possibly to individual water users. California's Department of Water Resources is required to periodically review potential water efficient water management practices and to provide technical consultation, training, and recommendations for agricultural efficiency improvements.

Political Leadership

Political leadership is the cornerstone of water conservation and efficiency efforts. Often there exists a "window of opportunity" when elected officials and the public are receptive to certain new ideas. Political leadership can take many forms. Sometimes an executive order is issued by a governor, such as when, in North Carolina, Governor Michael Easley issued an executive order calling for all state agencies to discontinue non-essential water use until the agencies developed conservation practices. Keyes et al., point out that while Albuquerque is considered a national conservation leader, New Mexico's statewide water conservation efforts have languished.

Stakeholder Involvement

Public and stakeholder involvement can make the difference between success and failure of a water conservation program. Effective water conservation takes place at several levels and requires the participation of policymakers, water supply utilities, and water users. Many components of water conservation are dependent on public buy-in of the resource-protection and personal benefits of water conservation. Communication between policymakers, water suppliers, and water users can provide policymakers the input and support needed to create water conservation programs that are responsive to local needs while meeting state objectives.

Water Use Data Collection and Forecasting

Water conservation and efficiency planning must be based on current water demands, projections of future needs, and available supplies, including potential alternative supplies, such as that provided by reuse projects. Universal metering is a key to establishing the current water demands so that the achievement of water conservation goals can be measured over time.

The submetering of apartments, in which each unit is billed separately for water use, is an important water conserving practice. Some states require submetering for newly constructed apartments, multiple-use facilities, and other similar units. In Texas, submetering is specifically allowed by statute and, with certain exceptions, it is required for new construction.

The Level at Which Conservation Programs are Implemented

States with statewide conservation programs generally have a strong sub-state component that allows local flexibility of how conservation goals are met. Regions typically differ significantly in their population growth rates and dominant types and amount of water use, as well as in social and economic makeup. Local flexibility in designing water conservation and efficiency programs is an important way to assure that water conservation planning considers these variations. At the same time, certain water conservation practices may warrant a statewide approach, as Georgia and other states have done regarding water-efficient plumbing fixtures. Federal laws require specific efficiency standards for the installation of plumbing fixtures in new construction.

State water programs may incorporate many elements of water conservation, but local governments, water utilities, regional institutions, and water users themselves might be required to develop water supply and conservation strategies. In California, each urban water supplier must prepare and adopt an Urban Water Management Plan. Public agencies that supply water in California are also authorized to implement water conservation and efficiency programs. In North Carolina, water systems whose demands are approaching 80 percent of available supplies are encouraged to develop demand management plans. The Texas Commission on Environmental Quality and the Texas Water Development Board are required to jointly develop model water conservation programs for different types of water suppliers. Texas also requires water conservation plans to be developed by certain individual water users: any entity applying for a new water right or an amendment to an existing right must submit a water conservation/ drought contingency plan with its application. Like the establishment of water conservation goals, water supply plans can be required of certain areas of the state that have more immediate conservation needs than others. This is true in Arizona (active management areas) and Florida (water resource caution areas).

Consideration of Disincentives to Water Conservation

The most common disincentive to water conservation is a declining or decreasing water rate structure which results in the per-gallon price of water to decrease as usage increases. In Georgia, public and private water suppliers are transitioning away from such rates in favor of rates that encourage conservation, but some counties continue to use declining rates as a way to attract certain businesses. In Massachusetts, the use of declining rates in water pricing is prohibited throughout the state, and within the jurisdiction of the Massachusetts Water Resources Authority (a public supplier serving 43 communities, including Boston), most municipalities and water districts must institute a base rate for water that increases at an increasing block rate.

In addition, certain incentives (for industry, commercial processes, energy production, etc.) that are seemingly independent of water resources may have unintended consequences of encouraging wasteful or excessive water use. Ordinances or covenants may also inadvertently encourage inefficient use of water resources, such as an ordinance that requires a certain amount of turf grass to be planted. Texas has approached this issue

by passing a law that specifically prohibits the creation or enforcement of restrictive covenants that undermine water conservation.

Required Versus Voluntary Conservation

Water conservation planning can incorporate required elements, voluntary practices, or a combination of the two. All of the states surveyed for this report use a combination of approaches. For certain proven conservation practices, it is common for states to require implementation statewide. In Florida, for instance, all newly-installed automatic lawn sprinklers must include a rain sensor device that overrides the system when adequate rainfall has occurred. As noted above, Massachusetts prohibits the use of declining rates in water pricing. Retail public water suppliers in Texas are required to perform a water audit every five years. For other practices, municipalities or water providers may be required to *consider* implementation, based on its economic and practical feasibility. For instance, in Florida, water resource caution areas are required to implement water reuse programs unless reuse is "economically, environmentally, or technically unfeasible." Also in Florida, municipalities must consider enacting ordinances requiring the use of Xeriscape methods as a conservation practice.

Another common way of requiring certain water conservation practices or to require conservation planning is to tie the permit application process to the development and implementation of water conservation efforts. Georgia already uses permitting to accomplish certain policy goals, and several of the states surveyed use this tool for encouraging and requiring water conservation. Florida uses permitting incentives for utilities that implement reuse programs as well as for consumptive use withdrawals. Applications for loans or grants for capital improvements to water supply infrastructure might also include provisions for water conservation. Both California and Florida include water conservation as a consideration in approving such grants and loans.

Implications for Water Conservation in Georgia

Although there is clear evidence among the states surveyed that certain recommended components, such as goals, stakeholder involvement, and technical assistance, are implemented, it is difficult to gauge the extent to which certain of the recommended components (particularly political leadership) are included in the water conservation programs of some states. Florida and California seem to have the most comprehensive water conservation programs and are especially strong in promoting the use of reclaimed water. North Carolina, with less water demand pressure relating to availability of water than some other states, seems to have the least restrictive program in terms of conservation practices required. In all of the states, a variety of state agencies, regional institutions, nonprofit organizations, and local public and private entities are involved in water conservation efforts.

As Georgia moves forward in developing a Comprehensive State-wide Water Management Plan, careful consideration of each of these questions will be critical to the success of programs developed and implemented at both a state and local level to make

better use of available water. It was noted by several water managers in the course of researching state water conservation policy that the early steps taken can be the most important to long-term success because they set the stage for the direction a state takes for years to come.

Water Conservation Practices

A variety of practices can be used to accomplish water conservation goals, and should be considered based on the needs for water conservation in specific sectors of water use. For the purpose of this report, conservation practices have been divided into five broad categories: Public Water Supply System Conservation, Residential Conservation, Commercial and Institutional Conservation, Industrial and Thermoelectric Conservation, and Agricultural Conservation. Categories were determined based on the dominant source of water (municipal supply versus direct withdrawal of surface or ground water), type and amount of use (large-scale versus small-scale or domestic versus industrial), and likely regulatory requirements (state-wide versus local).

Among the conservation categories, there are issues that span more than one category. For instance, reuse of reclaimed water is discussed primarily in the "Public Water Supply System Conservation" section, although reclaimed water use is a practice that can be implemented in each of the categories. Plumbing codes for water-conserving fixtures, in the "Residential Conservation" section, can be applied as well to commercial and institutional conservation. For each category, examples are provided to illustrate how water conservation practices have been used in several other states. References regarding conservation programs in other states are provided in Appendix A.

Public Water Supply System Conservation

Water utilities can play a major role in water conservation by structuring rates to encourage conservation, accounting for system losses and repairing leaks, regulating water pressure, metering and submetering water use, and treating reclaimed water for reuse. For the purpose of this report, the category of water utility conservation is limited to these activities, although utilities can also be instrumental in promoting residential water conservation by conducing public education programs and providing home water conservation kits that include information packets, faucet aerators, toilet displacement devices, leak detection tablets, and other items.

Water Pricing

Rates charged by water supply and wastewater systems can be an effective incentive for conserving water resources. The following rate structures are commonly used:

- *Flat, or unmetered, rates* are the same for all customers; the total monthly cost of water use does not vary with consumption, so that the price per gallon decreases as consumption increased. Flat rates are most commonly used in rural areas where there is relatively slow growth and little pressure on water resources.

- *Uniform rates* are the same for all customers and all levels of consumption: the per-gallon price remains constant. Some water systems have a base rate and a per-thousand-gallon rate for all use above the base rate. In terms of water conservation, this rate structure is generally considered a minimum standard. Its primary benefit is its simplicity.

- *Decreasing, or declining, block rates* are typically based on three tiers of consumption, with the lowest tier having the highest cost per gallon of water used, and the highest tier having the highest cost per gallon. Such rates discourage conservation by rewarding large water users with the lowest prices.

- *Increasing, or inverted, block rates,* also typically a three-tier structure, encourage conservation with per-gallon rates that increase as consumption increases. This rate structure has become quite widely used, particularly in fast-growing metropolitan areas where water conservation is a priority. It provides a clear economic incentive for customers to conserve water, and helps water systems stabilize revenues by lowering summer demand peaks. It is relatively simple to initiate and to explain to customers.

In recent years, as conservation and social goals have encouraged the use of more creative rate structures, several other types of rates have emerged:

- *Seasonal rates* are uniformly higher during periods of peak seasonal demand, typically during summer months due to landscape irrigation. Rates during the remaining months of the year are uniform. Like increasing block rates, seasonal rates help lower summer demand with a clear conservation incentive. The drawback of this structure, however, is that the rate applies to wasteful and efficient customers alike, essentially penalizing those customers who do not irrigate landscapes.

- *Non-essential use, or excessive use, rates* increase when consumption surpasses an established allotment or budget, and are individualized based on usage patterns. This type of rate structure is often applied as a "seasonal surcharge" on water used during peak summertime months. The difference between the non-essential use rate and the seasonal rate is that seasonal rates are applied to all customers, regardless of individual use, whereas nonessential use rates apply only to those customers who exceed their normal (i.e., winter) water use. Although a slightly more complex structure, this provides a more equitable incentive for waste reduction than seasonal rates, and can significantly reduce summer peaks.

- *Drought rates* are similar to seasonal rates, in that they are applied to all customer classes, regardless of individual consumption habits. One of the least common rate structures, they are applied for limited durations of water shortage in order to quickly reduce demand.

- *Hybrid rates* combine two or more rate structures, usually by customer class, for example, by applying non-essential rates to non-residential customers and inverted block or uniform rates to residential customers. Hybridizing rates helps to individualize pricing to meet the needs of a community. That value must be weighed against the reality that it brings a greater level of complexity to the billing process and, depending on the types rates combined and the customer classes to which they are applied, it may be difficult to explain its rationale to customers.

- *Lifeline rates* are lower rates, flat or uniform, that are applied to low-income water customers. These have become more popular in urban areas in recent years, and though not a water conservation tool, they may be used as part of a pricing strategy that includes other conservation pricing.

- *Impact fees* are often used to shift the costs of infrastructure development either to developers or to new users. These fees are generally used as a growth-management tool rather than a water conservation tool. If applied to new water customers, these fees are essentially tax relief practices for existing customers. (Jordan)

- *Rate discounting* can be used to encourage specific water-use behavior or technologies, and may apply to residential, commercial, or industrial water use.

Pricing Trends

Since the mid-1990s, more and more water utilities in the United States have begun to adopt "conservation pricing." This term is sometimes used to refer specifically to increasing block rates, but it can be used to describe any price structure that discourages wasteful use of water. As water supply systems contemplate such alternative rate structures, associated goals are to achieve water use efficiency without excessive price increases; engender understanding and acceptance among customers; maintain revenue stability; maximize simplicity (and minimize costs) of metering and billing; and minimize the potential for challenge or litigation.

Recent Georgia rate surveys were conducted by the University of Georgia's Carl Vinson Institute of Government, in cooperation with the Georgia Association of Water Professionals and the Georgia Municipal Association. These surveys allow comparison of rate structures of 93 municipal and county water systems in 2005 with data from a 1994/1995 survey (Jordan 1996). The most common rate structure at both times is the uniform structure (58 percent in 1994/5 and 63 percent in 2005). Declining block rates have become less common (30 percent in 1994/5 and 9 percent in 2005), while increasing block rates have become more common (10 percent in 1994/5 and 23 percent in 2005). Flat rates comprised only 2 percent and 1 percent, respectively. Several water systems have adopted a seasonal or excessive use surcharge (used in conjunction with a uniform rate) to help limit summertime irrigation. In addition, almost 10 percent of the water

systems indicated current consideration of a rate structure that encourages greater water conservation, such as increasing block or seasonal surcharges.

Among water systems that changed rate structures during this period (40 percent), the most common change was from declining block rates to either a uniform or increasing block structure. Thirty-eight percent of those changes were from declining block rates to uniform rates, with other common changes being from uniform to increasing block (22 percent) and declining block to increasing block (17 percent).

Georgia water system rate structures: a comparison between 1994/1995 and 2005

	1994/1995 (%)	2005 (%)
Uniform	58	63
Declining Block	30	9
Increasing Block	10	23
Flat	2	1
Seasonal/excessive use	0	4

Reuse of Reclaimed Water

Reuse of reclaimed water can be a valuable component of a conservation plan because it reduces reliance on other sources of water and reduces treatment costs. Reuse also offers a means for wastewater management that reduces environmental impacts associated with waste discharges into surface waters. *Reclaimed* water, sometimes referred to as "graywater," is generally domestic wastewater that has been treated to the extent that it is suitable for a variety of nonpotable uses. *Reuse* is the use of reclaimed water as a substitute for another water source. The most common use is for irrigation of residential, commercial, and public landscapes, but reclaimed water is increasingly used for industrial processes, fire protection, aesthetic purposes such as fountains, agricultural irrigation (feed crops), and dust control.

System Water Accounting and Leak Repair

If a utility has a significant amount of "unaccounted-for" water, or water that leaves the system but is not billed, it may be faced with unnecessarily high operating costs and the need for increased supply and treatment capacity. The standard accepted percentage of unaccounted-for water is 10 percent; some utilities have rates of 30 percent or greater, especially where infrastructure is aging.

Pressure Regulation

Because flow rate is related to pressure, the water flow from a fixture can be reduced if the water pressure is reduced. A reduction in pressure from 100 pounds per square inch (psi) to 50 psi can result in a water flow reduction of about one-third. Water providers

can reduce pressure during water transmission, and/or homeowners can reduce water pressure by installing pressure-reducing valves. Water pressure reduction can save water by not only reducing flow, but by reducing the incidence of leaks in pipes, water heaters, and faucets.

Submetering: Requirements for New Construction and Incentives for Retrofits

A recent study by American Water Works Association showed that the practice of installing individual water meters on multi-family apartment units resulted in average water savings of 15 percent, or 8,000 gallons of water per unit per year. The study estimated that about a quarter of the U.S. population lives in multi-family dwellings, and that the practice of billing tenants directly for water is increasing at a rate of 25 percent per year. (AWWA)

Public Water Supply System Conservation in Other States

Water utility conservation practices are among the most common approaches to water conservation in other states, as the following examples suggest.

Arizona

Municipal water providers within active management areas are required to develop and implement water conservation programs subject to requirements established by management plans developed by the Department of Water Resources for each active management area. Progressively stringent conservation practices are required in plans that correspond to five management periods, beginning in 1980 and continuing until 2025.

The *first management plans* (1980-1990) initiated basic water management programs through mandatory conservation requirements for major water users within the active management areas. The plans were required by statute to focus on per capita (gallons per capita per day) water use reductions. A total per capita use program was established as the base program for all municipal water providers. The higher the base year per capita rate, the higher the required reduction in per capita use, thus rewarding providers who had already attained low per capita usage. The 1980 population census and total water use were used to calculate each water provider's base year per capita rate.

The *second management plans* (1990-2000) established more comprehensive and aggressive conservation requirements, along with a water supply augmentation program to reduce reliance on ground water sources. These plans recognized the unique characteristics of various service areas and focused on analysis of the conservation potential for each service area, using 1985 as the base year. An alternative to the per capita use requirements is a program implemented in 2004, the "Alternative Municipal Conservation Program," which allows the implementation of a residential gallon-per-capita-per-day requirement and best management practices for the non-residential sector. This program is expected to achieve conservation savings at least equivalent to the Total Gallons Per Capita Per Day Program. The Department also adopted the Conservation

Assistance Grants Program in the second management period to provide financial, planning, technical, and other support services.

The *third management plans* (2000-2010) continue and refine mandatory conservation requirements and continues to encourage the use and storage of renewable supplies. During this management period, the Department is required to develop specific management tools. Mandatory conservation requirements were established for agricultural, municipal, and industrial ground water users and ground water distribution systems. (Mandatory conservation requirements were also established for agricultural, industrial, and distribution systems in the first and second management plans.) A second alternative program to the Gallons Per Capita Per Day Program was established for municipal water providers in this management plan. Called the Non Per Capita Conservation Program, it established a set of standard residential, non-residential, and educational Reasonable Conservation Measures with the aid of an advisory group of conservation program experts from the regulated community. Each conservation measure describes an action that must be taken by the water provider to achieve efficiency in each water use sector. The number of measures required of a water provider is dependent on the current per capita use rate and the service area's conservation potential.

Reasonable Conservation Measures include interior and exterior water audits; plumbing requirements and retrofit programs; prohibitions of covenants that require water-intensive landscaping or prohibit the use of low water use landscaping; landscape watering advice programs; and public information and education programs.

<u>California</u>

The California Urban Water Management Planning Act (CA Water Code §§10610 through 10657), adopted in 1983 and amended last in 2001, requires each urban water supplier to prepare an Urban Water Management Plan within one year after it has become an urban water supplier and update the plan at least once every five years on or before December 31, in years ending in five and zero. Plans must be filed within 30 days of adoption with the Department of Water Resources, the California State Library, and any city or county within which the supplier provides water supplies. Urban water management plans serve as long-range planning documents, provide source data for regional water plans and for cities' and counties' general planning efforts, and as a key component to Integrated Regional Water Management Plans (described below).

This statute affects all urban water suppliers, publicly or privately owned, who supply water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet annually (approximately 977 million gallons per year). The conservation component of the Urban Water Management Plans includes a description of each water demand management measure currently implemented or scheduled for implementation, including steps necessary to implement any proposed practices, including but not limited to the following:

- Water survey programs for single-family residential and multifamily residential customers;
- Residential plumbing retrofit;
- System water audits, leak detection and repair;
- Metering with commodity rates for all new connections and retrofits of existing connections;
- Large landscape conservation programs and incentives;
- High-efficiency washing machine rebate programs;
- Public information programs;
- School education programs;
- Conservation programs for commercial, industrial, and institutional accounts;
- Wholesale agency programs;
- Conservation pricing;
- Water conservation coordinator;
- Water waste prohibition; and
- Residential ultra-low-flow-flush toilet replacement programs.

In addition, the plan must include a description of method the water supplier will use to evaluate the effectiveness of water demand management practices, an estimate, if available, of existing conservation savings on water use within the supplier's service area, and the effect of the savings on the supplier's ability to further reduce demand. Any water demand management measure listed above that is not implemented or scheduled for implementation must also be evaluated.

Through a separate program, the Department of Water Resources and the California Urban Water Conservation Council frequently co-sponsor workshops on methods and software to assist water suppliers in leak detection and repair.

Florida

Florida is a national leader in terms of water reclamation and reuse, signified by a statewide slogan, "Use it Again, Florida!" Reuse has been identified as a critical element in Florida's ability to meet future water needs, and is an integral part of the state's water

conservation strategy. In the mid-1980s, the Department of Environmental Protection began development of a comprehensive Water Reuse Program, and several laws were passed to govern and encourage proliferation of wastewater reuse. Reuse is specifically encouraged and promoted by the 2001 Florida Water Plan, and as of recent amendments to the water code (Chapter 62-40), water reuse is required statewide unless it is economically, environmentally, or technically unfeasible. Within water resource caution areas, applicants for domestic wastewater permits are required to prepare reuse feasibility studies as part of their application process, with certain capacity exceptions. In addition, the Florida Legislature urges all water and sewerage systems to reduce connection fees and regular service charges for customers who use water-saving or sewer-saving devices, including gray water disposal systems (§ 373.619, F.S.). (A number of state-wide organizations and statutory provisions address reuse in Florida; please refer to Appendix A for additional information.)

Water management districts and local governments may develop additional reuse programs. In several areas within the South Florida Water Management District with limited water availability (Jupiter, Naples, Cape Coral, and Collier County) 100 percent of wastewater is reused. Regional coordination efforts also encourage reuse: the Lower West Coast Regional Irrigation Distribution System is being developed by a consortium of utilities (in Bonita Springs, Cape Coral, Fort Meyers, Naples, Collier County, and Lee County) to build a regional distribution system which will increase the use of reclaimed water, primarily for irrigation. The system is expected to significantly reduce the draw on the region's freshwater supplies by allowing communities to share reclaimed water.

Florida's utilities have refined their initial approach to marketing reclaimed water, and the lessons they have learned are instructive for Georgia. When Florida's wastewater utilities began to implement reuse systems in the late 1980s and 1990s, they were faced with the challenge of creating a market for their reclaimed water. Many customers were skeptical and reluctant to use reclaimed water and, to encourage use, many reclaimed water facilities provided reclaimed water at greatly reduced rates, or even at no cost. As customer bases grew, these low rates encouraged overuse and waste of reclaimed water, which became a burden for utilities. Facilities were designed to accommodate high summertime use, even though total annual use of reclaimed water was significantly lower. During summer months, demand was such that facilities struggled to provide enough water (especially during the drought of 2000-2001), and supplemental supplies from surface water or ground water sources were often required. During winter months, the facilities disposed of unused water.

The need to recognize reclaimed water as a valuable resource became clear, and several forums, including the 2000 and 2001 Reuse Roundtables (open, annual gatherings of environmental and water reuse professionals), focused on how to ensure that reclaimed water is used efficiently and effectively. The 2001 Florida Water Plan includes provisions related to this concept.

The most important work toward promoting greater efficiency of reclaimed water use came with the development of "Water Reuse for Florida: Strategies for Effective Use of

Reclaimed Water," jointly prepared by the Reuse Coordinating Committee and the Water Conservation Initiative's Water Reuse Workgroup, completed in June, 2003. The purpose of the report is to present general information on water reuse, summarize Florida's Water Reuse Program and the history of reuse in Florida, and identify 16 major strategies for using reclaimed water efficiently and effectively. The strategies generally call for the use of incentives rather than mandates. The strategies for "viewing reclaimed water as a valuable resource" and recommended for use in Florida are as follows:

- Encourage metering and volume-based rate structures;
- Implement viable funding programs;
- Facilitate seasonal reclaimed water storage (including aquifer storage and recovery);
- Encourage the use of reclaimed water in lieu of other water resource in the agricultural irrigation, landscape irrigation, industrial/commercial/institutional, and indoor water use sectors;
- Link reuse to regional water supply planning (including integrated water resource planning);
- Develop integrated water education programs;
- Encourage ground water recharge and indirect potable reuse;
- Discourage effluent disposal;
- Provide water use permitting incentives for utilities that implement reuse programs;
- Encourage reuse in Southeast Florida;
- Encourage the use of supplemental water supplies;
- Encourage efficient irrigation practices;
- Encourage reuse system interconnects;
- Enable redirecting of existing reuse systems to more desirable reuse options;
- Use reclaimed water at government facilities; and
- Ensure continued safety of water reuse.

The report also identifies topics that should be considered for legislative action and rulemaking changes. These include the creation of funding programs; encouragement of metering reclaimed water use and volume-based rates for reclaimed water use; added emphasis on reuse in regional supply planning; consumptive use permitting incentives; mandated use of reclaimed water at state facilities; and longer DEP permits for reuse programs.

Massachusetts

The use of descending (decreasing) rates in water pricing is prohibited throughout the state of Massachusetts: "No local body shall charge for water or sewer services on a descending unit rate basis." (M.G.L. § 40-39L) In addition, within the jurisdiction of the Massachusetts Water Resources Authority, all municipalities and water districts must institute a base rate for water that rises at an increasing block rate, with the exception of communities served by the Connecticut Valley Aqueduct (M.G.L. § 165-2B).

A number of standards and conditions are included in the Massachusetts Water Policy, adopted by the state in 2004. The policy calls for the development of a tiered framework of basin stress with a graduated menu of actions related to performance standards, including water efficiency, seasonal peak pricing, water reuse, and on-site wastewater recharge, leak detection, metering and others. The associated permitting policy requires the following standards and conditions for water suppliers and water users:

- Cap on per capita residential water use of no more than 65 gallons per capita for high and medium stress basins and no more than 80 gallons per capita for low stress and unassessed basins;

- Limits on unaccounted-for water of no more than 10 percent for high and medium stress basins, and no more than 15 percent for low stress and unassessed basins;

- Summer limits on withdrawal (limit varies based on prior use);

- Streamflow thresholds that trigger mandatory limits on nonessential outdoor water use, including but not limited to lawn and landscape irrigation;

- Standard and consistent reporting requirements; and

- Streamflow monitoring.

A document prepared in 1992 for the Massachusetts Water Resources Commission, *Water Conservation Standards for the Commonwealth of Massachusetts*, provides standards and recommendations to be used in all programs affecting the planning and management of the state's water resources and for use in all construction, rehabilitation, and facility development activities state-wide. Pertaining to water systems, the document sets forth the following requirements:

- Leak detection and repair:

    - A full leak detection survey of the distribution system should be completed every two years. Leak detection and repair should be recognized as expenses of the water supply system and included in a full-cost pricing structure.

- Metering:

    - Each public water supplier should develop a program to implement 100 percent metering of all public sector and private users with meters of proper size and accuracy to ensure full registering of water flow.

    - The metering program should include regular meter maintenance, including testing, calibration, repair, replacement, and checks for tampering to identify and correct illegal connections.

    - The metering program should include regular meter reading of all public sector users and regular accounting of their use.

    - Meter reading and billing for domestic accounts should be done quarterly, with the understanding that customers should be billed on actual meter readings.

    - Master meters (which register the flows in the municipal system) should be calibrated annually.

- Pricing:

    - The water pricing structure should include the full cost of operating the water supply system.

    - Water supply system operations should be fully funded by water supply system revenues.

    - Each water supplier should regularly evaluate existing rate structures, including any peak demand and seasonal pricing components. In addition, the water supplier should consider all possible pricing options, such as increasing block rates.

    - Water and sewer rates, were applicable, should be billed so as to inform customers of their actual use and the cost of each.

Please see Residential Water Conservation, below, for additional information pertaining to water supply system conservation in Massachusetts.

North Carolina

In North Carolina, permitting is required for ground water withdrawals (but not surface water withdrawals) of more than 100,000 gallons of water per day, and all permit holders are required to practice water conservation practices. Division of Water Resources rules require North Carolina's public water systems to develop conservation practices that include a water conservation ordinance for outdoor irrigation; a water loss reduction program; a conservation rate structure; a plumbing retrofit program; and a public education program.

The most recent State Water Supply Plan, released in January, 2001, provides general guidance for sub-state governments to implement conservation elements such as the development of a conservation ordinance that triggers mandatory water use reduction in times of water shortage; reduction of unaccounted-for water; establishment of rate structures; promotion of low-flow plumbing fixtures; outdoor water use; and information resources for public education. Thirty-one percent of the state's water supply systems have established leak detection programs, and another 26 percent of the systems are in the process of developing such programs.

Reclaimed water may be used in North Carolina for a variety of purposes, including agricultural and residential irrigation, industrial purposes (such as processing or cooling water), dust control, fire fighting, aesthetic purposes such as fountains, toilet flushing, vehicle washing, and other purposes. It may not be used for direct potable supply, to fill swimming pools or hot tubs, or for irrigation of direct food chain crops. If it is used to irrigate areas intended to be accessible to the public, specific guidelines are required to assure public safety. Additional requirements relate to detention ponds, buffer requirements, rates of application for certain uses, and transport and storage. (15-A NCAC .0200(K)) The primary use for reclaimed water in North Carolina is irrigation of golf courses, with a limited amount used for residential irrigation and industrial uses. More than eight percent of the water systems use reclaimed water, and the Town of Cary provides non-potable water through a parallel distribution system, to 400 residential and commercial customers.

Texas

Texas legislation passed in 1985 required retail water suppliers that received state funding and all recipients of new water rights to implement a water conservation plan and/or adopt a drought contingency plan, and this planning requirement was expanded in 1997 (Senate Bill 1) to include large municipal, industrial, and agricultural water users.

HB 3338 (T.W.C. § 16.0121) (2003) requires retail public water suppliers to perform a water audit every five years and submit the audit to the Texas Water Development Board. The audits must include a computation of the utility's most recent annual system water loss.

HB 2661 (T.W.C. § 26.0311) (2003) requires the Texas Commission on Environmental Quality, by rule, to adopt and implement minimum standards for certain uses of gray water. The legislation allows gray water to be used for certain agricultural, domestic, industrial, and commercial uses, with certain design criteria, provided that the use of gray water is not a nuisance and does not damage the surface or ground water of the state. Under specific requirements, the domestic use of up to 400 gallons of gray water per day does not require a permit.

The amended Texas Administrative Code Title 30, Chapter 288, became effective on October 7, 2004. The revised Chapter 288 Rules require specific, quantified five and ten year targets for water savings to be included in all water conservation plans and the adopted plans to be submitted to the Texas Commission of Environmental Quality by May 1, 2005, and thereafter by May 1, 2009, to coincide with the regional planning process. Plans must be developed by municipal users, wholesale public water suppliers, agricultural users, and industrial/mining users.

Plan requirements for municipal water use by public suppliers include the following elements:

- Specific, quantified 5 and 10-year conservation targets;
- Metering devices should be accurate plus or minus 5.0 percent and account for the amount of water diverted from the source of supply;
- Program for universal metering, meter testing and repair, and periodic meter replacement;
- Measure to determine and control unaccounted-for water;
- Continuing public education and information;
- Non-promotional rate structure, i.e., a rate structure which is cost-based and does not encourage excessive use of water;
- Reservoir systems operations plan, if applicable providing for the coordinated operation of reservoirs owned by the applicant;
- Enforcement procedure and plan adoption: a copy of ordinance, resolution, or tariff indicating official adoption of plan and a description of the authority under which water supplier will implement and enforce the plan; and
- Documentation of coordination with the regional water planning group(s).

For suppliers serving populations of 5,000 or more or a projected population of 5,000 or more within 10 years, the following additional requirements apply:

- Program for leak detection, repair, and water loss accounting; and

- Record management system to record water pumped, water deliveries, water sales, and water losses.

In addition, before the Texas Water Development Board grants a water supply project application or provides any funds under an application, it must require the applicant to adopt a program of water conservation for the more efficient use of water. (T.W.C.§ 17.125 (b)) The program may include but is not limited to:

- Restrictions on discretionary water uses, such as lawn watering;

- Plumbing code standards for water conservation in new building construction;

- Retrofit programs to improve water use efficiency in existing buildings;

- Educational programs;

- Universal metering;

- Conservation-oriented water rate structures;

- Drought contingency plans; and

- Distribution system leak detection and repair.

Summary of Public Water Supply System Conservation in Other States

Water utilities, local governments, and/or state agencies in the states surveyed are generally required by statute to develop water conservation plans. These plans may include specific requirements for agricultural, municipal, and industrial water users, and may be progressively more stringent over time or may call for conservation practices that are more stringent in some regions than others. In some cases, large water users must also develop water conservation plans. Most of the states provide guidelines or requirements for the development of such plans, which generally include the following elements:

- Metering;

- Leak detection and control of unaccounted-for water;

- Encouragement of reuse of reclaimed water;

- Public education;

- Landscape irrigation/planting guidelines for property owners; and

- Plumbing standards and retrofit programs.

Residential Water Conservation

Residential water conservation includes practices to reduce water used for washing clothes, flushing toilets, bathing, and cleaning, as well as for outdoor uses such as landscape irrigation, washing cars and outdoor surfaces such as driveways, and ornamental water features and pools.

Indoor Water Use

Indoor water conservation can be accomplished to a large extent by establishing standards for plumbing fixtures and appliances, such as low-flow toilets and showerheads and water-efficient clothes washers.

Plumbing Practices

One of the most common water conservation practices is to encourage or require the use of certain types of plumbing fixtures.

- *Requirement of water-efficient fixtures in all new construction*: Building codes would require inspection of property before occupancy to ensure compliance.

- *Requirement of retrofits of water-efficient fixtures upon resale*: Local governments could coordinate with real estate industry to require that a plumber inspects the property to ensure that efficient fixtures exist or will be installed by the closing date of property settlement.

- *Rebates for water-efficient fixtures for existing homes*: Homeowners could be offered rebates or vouchers for fixtures such as low-flow shower heads and low-flow toilets. Rebate program may include waterless urinals and/or dual-flush toilets.

- *Distribution of retrofit kits with low-flow showerheads*: In conjunction with a home audit program or through a water system mailing, retrofit kits could be offered. Such kits typically contain a low-flow showerhead, toilet leak detection dye tablets, a toilet displacement device, a faucet aerator, faucet washers, and information on home water conservation.

- *Requirement of insulated hot water piping*: Building codes would require installation of hot water pipe insulation on all new construction.

- *Rebates for hot-water-on-demand units*: Homes are typically larger and water fixtures are often farther from water heaters than they were 40 or 50 years ago. As a result, a significant amount of water can be lost in the process of waiting for hot water to arrive at showers and sinks. Several styles of “hot-water-on-demand”

systems have appeared on the market, including recirculating pumps, point-of-use hot water heaters, and tankless water heaters. Each type of system can typically save a significant amount of water, but consideration should be given to the relative energy use of each type.

- *Home leak detection and repair*: Water systems could offer water audits for single-family homes (possibly on a rotating schedule so that a percentage of water customers would be audited each year). Program could focus initially on older homes or low-income homes.

Appliances

Use of more efficient appliances can save surprisingly large amounts of water over time.

- *Rebates for efficient dishwashers and/or clothes washers (such as horizontal axis)*: Homeowners would receive rebates or vouchers for high-efficiency washers. (Newer standard top-loading machines average about 39 to 43 gallons per load, while high-efficiency washers average about 27 gallons per load. Water-efficient dishwashers use from 4.5 to 7 gallons per load, compared with 7 to 14 gallons for standard models. (Vickers, pp. 115,126)

Technical Assistance

A common impediment to water conservation is lack of knowledge of the many ways that water savings can be accomplished in the home.

- *Residential water audits*: Leak detection audits could be expanded to include an analysis of all water use in the home, with a focus on improving efficiency both indoors and out.

Public Education

Public education is critical if residential water conservation is to be successful. Education efforts may be sponsored by governmental entities or water utilities.

- *Homeowners' guides to water conservation*: Booklets giving tips on home water conservation could be distributed with water bills, upon new service requests, in conjunction with school programs, etc.

- *Homeowners' guide to a self water audit*: Homeowners could be instructed in methods for detecting and repairing leaks and increasing water efficiency in the home. Such a guide could be distributed with a home leak detection and repair kit. This information could also be provided on a web site (the URL could be advertised in the water bill).

Recognition Incentives

Incentives for water conservation help build public awareness of the benefits of water conservation and of practices that homeowners can use to reduce water use.

- *New home efficiency awards*: Builders could be awarded for surpassing building code requirements for water-efficient plumbing fixtures and including other water saving elements in new home construction.

- *New home efficiency rating*: A program could be established that assigns a point value to certain water-efficiency practices applied in new home construction, such that home buyers can compare homes according to their water efficiency.

Other Indoor Water Use

A variety of creative practices can be used to promote water conservation by both homeowners and builders.

- *Developer-financed conservation projects*: Developers could be required to contribute to a water conservation program to help generate water needed for their projects.

Outdoor Water Use

Outdoor water use includes landscape irrigation, washing cars and outdoor surfaces, and ornamental water features and pools.

Landscape Irrigation

The greatest amount of water used residentially is generally for landscape irrigation, thus one of the most effective ways to reduce residential water use is to make landscape irrigation more efficient and to choose landscaping plants that require less irrigation.

- *Permanent irrigation restrictions*: Year-round limits on homeowner irrigation could be maintained, allowing irrigation at only specified times of the day and/or on certain days (even/odd by house number).

- *Water budgets*: A water budget would be established based on landscaping square footage, with usage over budget surcharged.

- *Rebates/requirements for rain sensor/shut-offs on automatic irrigation systems*: The installation of these devices could be required on all new construction and/or rebates could be offered to homeowners of existing homes.

- *Rebates/requirements for high-tech irrigation controllers or dedicated irrigation meters*: Rebates could be offered for existing homes, and/or new homes could be

required to include irrigation systems with advanced irrigation controllers that have a multiple start/stop times and a water budgeting feature, in addition to rain sensor shut-offs.

- *Financial incentives for irrigation upgrades*: Water rates could be lower for those customers who install advanced irrigation controllers that have a multiple start/stop times and a water budgeting feature, in addition to rain sensor shut-off.

- *Water-efficient landscaping at new homes/turf limitations*: Ordinances could require that new landscapes contain no more than a specified percentage of turf grass or other high water use plants.

- *Homeowner irrigation classes*: Homeowners could be instructed in irrigation-efficiency techniques, Xeriscaping techniques (see description below), rainwater management and harvesting, and other water conservation ideas.

- *Xeriscape education/demonstration gardens*: Xeriscape landscaping encompasses a number of steps for making landscapes more water-efficient, including:

    - Landscape planting and design that seeks to reduce maintenance;
    - Practical turf areas: limiting the amount of turf by using alternatives such as mulches and drought-tolerant ground covers;
    - Using mulch for water-retention and weed control;
    - Efficient irrigation, including grouping plants to maximize irrigation efficiency;
    - Planting native species and/or species well suited for native conditions;
    - Soil analysis to improve soil quality for better water absorption/retention; and
    - Maintaining landscape properly

<u>Recognition Incentives</u>

Like indoor water conservation incentives, outdoor incentives can increase public awareness of ways to conserve water.

- *Water conservation contests*: Neighborhood association competitions could provide incentives for neighborhoods to conserve by installing water-efficient landscapes and/or installing water-efficient irrigation systems.

<u>Other Outdoor Water Use</u>

Certain wasteful types of outdoor water use can be reduced by incentives or requirements.

- *Prohibition of non-recycling fountains and other non-efficient water features*: Circulating pumps could be required in decorative water feature so that water loss is limited to evaporation.

Residential Water Conservation in Other States

Closely related to utility water conservation and often coordinated by local utilities or local governments, residential water conservation is a vital component of water conservation programs. The following examples illustrate the emphasis that other states place on achieving residential water savings.

Arizona

Many communities in Arizona have developed aggressive local conservation programs. In Phoenix, where residential use dominates water demand, residential programs such as seasonal rate variations, low-flow plumbing fixture codes and retrofits, water audits, public education, and technical assistance have resulted in savings, as of 2002, of 40 million gallons per day (mgd).The City of Gilbert has instituted a multifaceted program that includes reuse of reclaimed water, building code requirements, a low-water-use landscaping program, an increasing block rate structure, public education, and a wastewater recharge system that has freed five billion gallons of water for recreation, wildlife habitat, and ground water recharge. Tucson has codified several aspects of its conservation program with ordinances regulating water waste, Xeriscaping, low-flow plumbing fixtures, and emergency conservation.

California

Droughts that California experienced in 1975-1976 and 1987-1993 brought awareness of the need to use water efficiently, and since then, water conservation has become a way of life for most Californians, most of whom have easy and affordable access to a wide array of off-the-shelf water efficient plumbing fixtures, washing machines, landscape irrigation systems, and water-thrifty plants.

In 1991, the California Water Council was formed as a governing body an overseer of water conservation. The signatories of the Council, including 189 water suppliers (representing more than 70 percent of California's water deliveries), 30 environmental/ public advocacy groups, and 118 groups representing interested parties, entered into a Memorandum of Understanding that focuses on a set of best management practices (BMPs) intended to reduce the long-term urban demands on water supplies. The water suppliers and advocacy groups establish BMPs, and signatory water suppliers must submit standardized annual reports to the Water Council to assess conservation progress relative to BMP implementation.

California's Water Conservation in Landscaping Act of 1990 (CA Government Code §§ 65591-65600) required the Department of Water Resources, with the assistance of an advisory task force, to develop a model water efficient landscape ordinance. By no later than January 31, 1993, if they had not done so already, each local agency was required to file with the Department either a water efficient landscape ordinance or findings, based on water availability or climatic, geological, or topographic conditions, stating that such

an ordinance is unnecessary. If a city or county failed to adopt an ordinance or submit findings by January 31, 1993, the model ordinance developed by the Department was to be enforced by the local agency. The model ordinance includes the following provisions:

- Water conservation through the appropriate use and groupings of plants that are well adapted to particular sites and conditions (however, an ordinance may not prohibit or require specific species);

- Use of automatic irrigation systems and seasonal irrigation schedules incorporating conservation design, and utilizing design and irrigation methods that ensure a high degree of water efficiency;

- Grading and drainage to promote healthy plant growth and prevent excessive erosion and runoff;

- Use of recycled water supplied through dual distribution systems, if feasible and cost effective, and subject to appropriate health standards;

- Educate water users on the efficient use of water and the benefits of doing so;

- Address regional differences where necessary and feasible;

- Exempt landscaping which is part of a registered historic site, where feasible;

- Use of economic incentives to promote the efficient use of water; and

- Landscape maintenance practices which foster long-term landscape water conservation.

The Office of Water Use Efficiency Programs**, t**hrough its Landscape Water Use Program, collects and maintains data related to landscape acreage and water use, promotes water budget irrigation scheduling, develops Geographic Information System (GIS) products to promote landscape water use efficiency, coordinates with the California Urban Water Use Council to support best management practices for large-landscape irrigation, and develops water efficient landscape projects in cooperation with local, state, and federal agencies. Current programs include working to promote the use of water-efficient landscapes and irrigation systems and evapotranspiration-based irrigation schedules.

The Water Recycling Act of 1991 (California Water Code §13577) made legislative findings regarding the environmental benefits and public safety of using recycled water as a reliable and cost-effective method of helping to meet California's water supply needs. The statute sets a goal 700,000 acre-feet (approximately 228 trillion gallons) of recycled water to be used annually by the year 2000.

The Water Conservation Bond Law of 1988 (CA Water Code § 12879 et seq.) was enacted to provide state financial support for local water projects and programs, including voluntary water conservation programs and ground water recharge projects. The statute creates the 1988 Water Conservation Fund, in which state funds are allocated to the Local Water Projects Assistance Account and the Water Conservation and Ground water Recharge Account. Through these accounts, the Department of Water Resources may make loans to local agencies, upon approval by the legislature, to aid in the construction of projects and in funding of voluntary, cost-effective capital outlay water conservation programs and ground water recharge facilities.

Florida

In addition to the use of reclaimed wastewater, discussed above, a key focus of Florida's residential water conservation efforts is residential lawn and landscape irrigation. As of May, 1991, any person who purchases and installs an automatic lawn sprinkler must install, maintain, and operate a rain sensor device or switch that will override the irrigation cycle of the sprinkler system when adequate rainfall has occurred (373.62, F.S.). Water management districts are required to work with 10 specified agencies and organizations to develop landscape irrigation and Xeriscape design standards for new construction, and local governments must use the standards and guidelines when developing landscape irrigation and Xeriscape ordinances. Other sections of the Florida Statutes relate specifically to requirements for Xeriscaping (also referred to as "Florida friendly landscaping"). For instance, section 166.048, F.S., requires the governing body of municipalities to consider enacting ordinances requiring the use of Xeriscape as a conservation practice, and to enact such ordinances if the finding is that Xeriscape would be of significant benefit. Each water management district must adopt rules governing the review and approval of local government ordinances and must provide model Xeriscape code and other technical assistance to local governments (§ 373.185, F.S.).

Water management districts and local governments have implemented a variety of additional water conservation and efficiency programs. For instance, the Southwest Florida Water Management District prohibits irrigation of lawns and landscapes between the hours of 10:00 a.m. and 4:00 p.m., and regulates irrigation by an odd-even schedule. Hand watering is allowed, if done with a self-canceling or automating shut-off nozzle, at any time, and other exceptions apply to newly installed lawns and landscapes.

The Tampa Water Department has also implemented water conservation practices, including an increasing block rate structure, public and in-school education programs, plumbing retrofit programs, and other demand-reducing practices. The City of Tampa has also promoted water efficiency by adopting plumbing and landscaping codes, imposing water use restrictions, and charging fines for water use violations. The city also provides free homeowner irrigation evaluations and rain sensors through its "Sensible Sprinkling" program. The combined result of these programs has been a savings of millions of gallons of water per day. Water conserved by the Sensible Sprinkling program is estimated at 25 percent, and Tampa's toilet rebate program alone has saved

approximately 245.9 million gallons of water per year. From 1989 to 2001, per capita water use decreased by 26 percent.

Tampa is also a leader in residential wastewater reuse: the South Tampa Area Reclaimed Project (STAR) distributes highly treated wastewater to residents and businesses for lawn and landscaping irrigation. Phase One of the project, scheduled for completion in 2005, will serve more than 5,000 residents and is expected to save more than 3.2 million gallons of potable water per day during Tampa's dry season. Phase Two will expand STAR to additional areas of the city.

Massachusetts

An aspect of Massachusetts' Interim Guidelines on Reclaimed Water, revised in 2000, is a requirement for promoting public awareness of regulatory and infrastructure decisions regarding reuse of reclaimed water, in order to promote public acceptance of reclaimed water. Public awareness programs must include the following:

- Facilities must publish and have available brochures or fact sheets explaining the process used to treat and deliver reclaimed water, the benefits to the community, and the safeguards employed to make the use of reclaimed water safe for users and abutters.

- All reclaimed water plumbing and out-of-sight fixtures must be color coded purple.

- Signs must be posted and portrayed symbolically where public access to reclaimed water is possible, clearly communicating that it is not for drinking. Signs should be in English and any additional locally employed language.

Massachusetts' *Water Conservation Standards for the Commonwealth of Massachusetts*, mentioned above (See Public Water Supply System Conservation), includes requirements that pertain to for residential water use. First, water suppliers, in cooperation with manufacturers and professional organizations, should make available to residential users at least one of the following water saving devices: low-flow showerheads, faucet aerators, toilet displacement devices and/or low-flow toilets, leak detection kits, and educational literature about installation and water conservation savings (in gallons and dollars), including outdoor watering and Xeriscaping. In addition, communities are expected to conduct public education programs, including most, if not all items on the following list:

- The largest users should be targeted early to realize the greatest potential savings and to demonstrate the benefits of a conservation program.

- Public education should reach to the schools; develop/use media that will appeal to children, including getting them involved with environmental/water resources projects and field trips.

- Bill stuffers and/or bills should have a work sheet on the reverse to enable customers to track water use and conservation efforts and figure the dollar savings.

- Public space advertising/media stories on successes (and failures).

- Conservation information centers, perhaps run jointly with electric or gas company.

- Speakers for community organizations.

- Public service announcements; radio/T.V./audio-visual presentations on supply sources and current status.

- Joint advertising with hardware stores to promote conservation devices.

- Use of civic and professional organization resources.

- Special events such as conservation fairs.

- Multilingual materials should be available as needed.

- Contests and recognition for innovation could be incorporated into the public education program.

- Information on Xeriscaping, gardening, and lawn care practices.

On a regional level, the Massachusetts Water Resources Authority, a public water supplier serving 43 communities, including Boston, implemented an aggressive water conservation program in 1986 to address a long-standing problem of withdrawals that exceeded safe yield. Since 1989, withdrawals have been below the safe yield, due to the combined effect of the following water supply and residential water conservation practices:

- Vigorous leak detection and repair efforts on Authority and community pipes;

- Retrofitting 370,000 homes with low-flow plumbing devices;

- A Water Management Program for area businesses, municipal buildings, and non-profit organizations;

- Extensive public information and school education programs;

- A change in the state plumbing code requiring new toilets to be 1.6 gallons per flush;

- Meter improvements that helped track and analyze community water use;

- New water-efficient technology that created reductions in residential use; and

- Water pipeline replacement and rehabilitation projects throughout the Authority and community systems.

North Carolina

Voluntary residential practices include home water audits, replacing inefficient plumbing fixtures, outdoor irrigation efficiency, and Xeriscaping. Local programs, particularly in the Town of Cary, have achieved significant water savings. Cary is frequently cited as an example of effective local water conservation. Between 1990 and 2000, Cary's population grew from 43,858 to 96,217, placing significant stress on the town's water resources. The town responded by developing a water conservation program designed to reduce per-capita water use by 20 percent by 2020. Conservation practices implemented include an extensive public information and education program; conservation education for elementary school students; workshops on water efficient landscaping and irrigation techniques; and a "Block Leader" program, in which volunteer leaders attend a training session and optional workshops and distribute informational materials to their neighbors.

Texas

Texas has implemented a number of practices related to residential water conservation, including the following:

- In 1991, the Texas Legislature passed the State Water Savings Performance Standards for Plumbing Fixtures Act, which established low-flow performance standards for plumbing fixtures including shower heads, faucet aerators, toilets, and urinals.

- Senate Bill 1, 1997, allowed local authorities to grant property tax exemptions for water conservation practices.

- House Bill 643, passed in 2003, prohibits the creation or enforcement of certain restrictive covenants that undermine water conservation.

- The Texas Commission on Environmental Quality is required by statute (T.W.C. § 13.503) to encourage submetering of individual rental or dwelling units by master meter operators or building owners to enhance the conservation of water resources. With certain exceptions, submetering or individual metering of such units is required for new units on which construction began after January 1, 2003. (T.W.C. § 13.502)

- The Texas Water Development Board, on request, must assist counties and municipalities by providing a model Xeriscape code and other technical

assistance, and is expected to work with counties and municipalities to promote, through educational programs and publications, the use of Xeriscape in existing residential and commercial development. (T.S. Chapter 373)

Summary of Residential Water Conservation in Other States

The states surveyed for this report place an emphasis on residential water conservation, particularly on landscape irrigation efficiency practices. Some state agencies are required to develop Xeriscaping and irrigation efficiency model ordinances or standards for adoption by local governments, and at least one state (Florida) has enacted statutory requirements for the use of rain sensors on automatic irrigation systems. Most of the states have implemented a program that encourages or requires water utilities to provide educational materials or opportunities for homeowners, and water utilities often supply kits for increasing water efficiency in the home. The most common residential water conservation practices used in the states surveyed are the following:

- Water-efficiency plumbing and appliances;
- Public education;
- Xeriscaping requirements; and
- Landscape irrigation standards.

Commercial/Institutional Water Conservation

Commercial and institutional water conservation is similar in many ways to residential water conservation, but may be tailored at least to some extent to the type of facilities targeted for conservation.

Indoor Water Use

Like residential indoor water use, indoor commercial and institutional water conservation can be accomplished by encouraging or requiring water-efficient plumbing fixtures. Additional water saving practices can be identified, depending on the type of facility.

Plumbing Practices

Commercial and institutional plumbing practices can serve as models for residential plumbing practices.

- *Water-efficient fixtures in all new construction*: All new construction could be required to include water-efficient plumbing fixtures. Building codes would require inspection of property before occupancy to ensure compliance.

- *Retrofits of water-efficient fixtures upon resale*: Local governments could coordinate with the real estate industry to require that a plumber inspects the property to ensure that efficient fixtures exist or will be installed by the closing date of property settlement.

- *Self-closing faucets*: All new commercial and institutional facilities could be required to install automatic or manual self-closing faucets.

- *Rebates/requirements for waterless urinals and/or dual-flush toilets*: Commercial and public facilities could be required or be given rebates to install water fixtures that provide even greater conservation benefits than typical low-flow fixtures.

Water Use Analysis/Technical Support

Commercial and institutional settings vary in their water needs and the opportunities afforded for water conservation, and appropriate conservation practices must often be determined by individual analysis.

- *Water audits and feasibility reports*: Free water audits could be offered to identify and evaluate the cost-effectiveness of possible water conservation practices.

- *Targeted water audits and rebate/retrofit programs for hotels, restaurants, and other public facilities*: Free water audits could be offered to identify potential practices for specific businesses and public facilities, along with a rebate or retrofit program for plumbing fixtures and certain process equipment for activities such as food preparation, laundry, sanitation, and car washing.

- *WAVE Program (sponsored by the USEPA) for hotels*: Water providers or local governments could provide information and encourage hotels to participate in this water-use analysis program. Hotels perform a water audit and use the USEPA software to analyze water use, identify conservation options, and compute paybacks on conservation investments.

- *Technical support/requirements for the use of reclaimed water*: Education and training could be offered for the use of reclaimed water for certain water uses, such as landscape irrigation.

- *Employee education programs*: Local governments could provide or require conservation education programs for employees of public facilities, including both indoor and outdoor conservation practices for the workplace as well as at home.

- *Water use reduction goals*: Specific goals for reducing overall water use could be established for government and/or commercial facilities

Other Indoor Water Use

Commercial and institutional facilities offer a variety of opportunities for creative water conservation practices, including site-specific practices, water budgeting, and incentives.

- *Water-efficient equipment:* Efficient process equipment could be required at all new facilities. For existing facilities, rebates could be offered to promote the replacement of inefficient equipment.

- *Financial penalties for water use exceeding budget*: Commercial and public facilities could be required to establish a water budget, above which there would be a surcharge or higher water rates.

- *Award program for water-efficient businesses and organizations*: An annual award program could reward the most efficient members of the community to raise water conservation awareness.

Outdoor Water Use

Depending on the type and location of the facility, outdoor water use may be a primary focus of water conservation practices.

Landscape Irrigation

Water conservation practices used in large-scale commercial and institutional landscapes can translate to significant water savings. In addition, the visibility of landscape irrigation practices used at commercial and institutional facilities can increase public awareness of water-saving methods that can also be used for residential landscaping.

- *Permanent irrigation restrictions*: Year-round limits on commercial/institutional irrigation could be maintained, allowing irrigation at only specified times of the day and/or on certain days.

- *Water efficient landscape designs and irrigation systems:* Local governments could require or provide incentives for the installation of efficient landscapes (e.g., using Xeriscaping techniques) and landscape irrigation systems.

- *Rebates/requirements for rain sensor/shut-offs on automatic irrigation systems*: Local governments could require the installation of these devices on all new construction and/or offer rebates to existing establishments.

- *Rebates/requirements for high-tech irrigation controllers or dedicated irrigation meters*: Rebates or requirements could be established for the installation of advanced irrigation controllers that have a multiple start/stop times and a water budgeting feature, in addition to rain sensor shut-offs.

- *Financial incentives for irrigation upgrades*: Water rates could be lower for those customers who install advanced irrigation controllers that have a multiple start/stop times and a water budgeting feature, in addition to rain sensor shut-off.

- *Water-efficient landscaping at new facilities (turf limitations)*: Ordinances could require that new landscapes contain no more than a specified percentage of turf grass.

- *Irrigation budgets for commercial customers*: A landscape irrigation water budget could be established for all accounts that have a separate irrigation meter.

Water Use Analysis/Technical Support

Site-specific analysis is often needed to achieve desired water conservation results.

- *Irrigation audits of large turf areas:* Audits could be conducted for large landscaping facilities and facilities with large turf areas to identify conservation opportunities.

- *Technical support/requirements for the use of reclaimed water*: Local governments or water providers could provide education and training for – and possibly require – the use of reclaimed water for certain water uses, such as landscape irrigation.

Education and Training

Knowledge of commercial and institutional staff members can play an important role in the success of water conservation programs, especially those employees who have landscaping and landscape maintenance roles.

- *Training landscape maintenance personnel regarding water-efficient planting and irrigation*: Educational opportunities/requirements could be established regarding irrigation efficiency and Xeriscaping techniques (see Residential Water Conservation) for personnel who design, plant, and maintain landscapes.

- *Staff training at retail garden/irrigation supply houses*: Requirements or incentives could be established for conducting staff training regarding irrigation efficiency and Xeriscaping techniques so that this information can be used for in-house processes as well as shared with customers.

Other Outdoor Use

Other outdoor uses, such as ornamental water features, in commercial and institutional settings can also offer water conservation opportunities. Businesses that rely on water, such as car washes, may employ site-specific conservation practices.

- *Prohibition of non-recycling fountains and other non-efficient water features*: Commercial and public facilities could be required to install circulating pumps in decorative water feature so that water loss is limited to evaporation.

- *Reuse of water at car washes:* All new drive-through car washes could be required to recycle water.

Commercial/Institutional Water Conservation in Other States

Commercial and institutional water conservation practices are often similar to the practices adopted for residential use. As the following examples illustrate, state facilities are often called upon to set water conservation examples for residents.

Florida

As reuse has become an integral part of water and wastewater management in Florida, state facilities are required, as feasible, to use reclaimed water. Florida Code 403.0645 requires state facilities to use reclaimed water to the greatest extent possible for landscape irrigation, toilet flushing, aesthetic features such as decorative ponds and fountains, cooling water, and other useful purposes allowed by department rules at state facilities, including but not limited to, parks, rest areas, visitor welcome centers, buildings, college campuses, and other facilities.

State-wide, publicly owned buildings or facilities constructed after June, 1992, are also required to use Xeriscaping techniques, with phasing of its use in facilities constructed before this date (§ 255.259, F.S).

Massachusetts

Massachusetts' *Water Conservation Standards for the Commonwealth of Massachusetts*, mentioned above (See Public Water Supply System Conservation and Residential Water Conservation), includes requirements that pertain to industrial, commercial, and institutional water use:

- All industrial, commercial, and institutional water users should develop and implement a written water policy, addressing among other items: demand management, leak detection and repair, a program of preventative maintenance, and a program of employee education.

- All industrial and commercial water users should carry out a water audit to determine the location and amount of water used for heating, cooling, processing, sanitary use, and outdoor use. The audit should serve to identify functions, activities, and locations where water savings could be readily achieved and the extent to which modifications could reduce or eliminate unnecessary water use.

- In new and renovated buildings, comply with plumbing codes and use the best available technologies for water conservation.

The document also includes a section of requirements specific to public sector water use, as follows:

- Government facilities, including school departments and hospitals should account their full use of water.

- Public buildings should be built or retrofitted with equipment that reduces water use.

- Water used by contractors using fire hydrants for pipe flushing and construction should be metered and they should be charged, including service fees.

- Irrigation of municipal property should be sensitive to soil moisture or should be subject to operational procedures that avoid watering during the hottest part of the day or during precipitation events.

- Strictly apply plumbing codes and incorporate other conservation practices in new and renovated buildings.

North Carolina

In the fall of 1998, Governor James Hunt issued a challenge to the state government to set an example of environmental stewardship, which has become known as North Carolina Project Green. The program has been quite successful and has garnered the participation of approximately 30 agencies. Initially, the program emphasized energy conservation, reduction of solid waste, and other environmental impacts, but since the inception of programs in 2001 and 2002, it has become focused on water conservation as well.

In response to ongoing drought conditions, in 2002 Governor Michael Easley called for all state agencies to discontinue "non-essential" water use until further notice and for all such agencies to develop and begin implementing long-term, financially feasible conservation practices (Executive Order No. 26). The order also requested that all other state-sponsored institutions comply with those directives. Because no further notice regarding non-essential water consumption was given, state government agencies were not allowed to use water for non-essential uses until they developed and began implementing water conservation practices. To help agencies and institutions develop conservation plans, the Division of Pollution Prevention and Environmental Assistance created an informational web page and sample plan, and offered individual guidance.

Ratified in October 2002, House Bill 1215 established a goal for state agencies to reduce water consumption by at least 10 percent. It also required the Department of Environment

and Natural Resources (NCDENR) to evaluate conservation practices being implemented by the state and identify incentive programs and other voluntary programs to help foster water conservation and reuse.

Another program that promotes water conservation at state agencies is the Utility Saving Initiative, led by the State Energy Office, which assists state agencies and universities to reduce utility costs, including water. Low interest loans are offered to wastewater and water systems based on funding priority points based on different rating variables. Additional priority points are awarded for the implementation of conservation practices.

Division of Water Resources rules require commercial facilities to audit water use by type of activity (processing, cooling, etc.), including existing and potential conservation and reuse practices for each type. They must also develop an implementation schedule for feasible practices identified.

North Carolina businesses may participate in water conservation certification programs, which save an estimated 90 million gallons per year. When water use restrictions were imposed in 2002, certified businesses were exempted from water use surcharges.

Texas

The State Energy Conservation Office is required to establish and publish mandatory energy and water conservation design standards for each new state building or major renovation project, including a new building or major renovation project of a state-supported institution of higher education. Procedural standards for water conservation must address water conserving fixtures, appliances and equipment; water-conserving landscape irrigation equipment; landscaping practices, such as landscape contouring and soil amendments, that increase water-holding capacity of soil; rainwater harvesting equipment; equipment for recycling or reusing water originating on the premises or from other sources; equipment needed to capture water from nonconventional, alternate sources; and metering equipment needed to segregate water use in order to identify water conservation opportunities or verify water savings. (T.S. § 447.004)

In addition, the Texas Commission on Environmental Quality, in consultation with the Texas Natural Resource Conservation Commission, the Texas Department of Transportation, and the Industry Advisory Committee, by rule, must adopt guidelines for the required use of Xeriscape on state property associated with the construction of a new state building, structure, or facility that begins on or after January 1, 1994, and must develop a five-year program for phasing in the use of Xeriscape on structures built prior to January 1, 1994. (T.S. § 2166.404-2166.405)

Summary of Commercial/Institutional Water Conservation in Other States

Commercial water conservation practices used in other states tend to be quite similar to residential practices; however, more stringent requirements are generally established for institutional water conservation. It is common for state facilities to be required to adopt

water conservation practices such as landscaping and irrigation standards, reuse of reclaimed water, and use of water-saving plumbing and fixtures. State facilities may also be required to conduct water audits to determine additional opportunities for increasing water use efficiency.

(See also Residential Water Conservation.)

Industrial and Thermoelectric Power Water Conservation

Industrial water users typically use water for four primary purposes: cooling and heating, processing, washing, as a product or process ingredient, and various outdoor uses. Because water saving potential is highly industry specific and site specific, the most common strategy for industrial water conservation is to conduct an *on-site audit*, in which water use and water-related costs are calculated and the feasibility of implementing more water-efficient processes or technologies is analyzed. Although initial investments may be large, water savings can often result in investment paybacks of a year or less. In Georgia, P^2AD provides this type of auditing.

- *Requirements/technical support for the adoption of alternative technologies*: Certain processes could be required or offered technical assistance to use water-saving technologies, based on their cost-effectiveness and other factors.

- *Requirements/technical support for the use of reclaimed water*: Many industrial processes do not require potable water but a lack of knowledge or incentives may inhibit the use of reclaimed water.

- *Cooling tower regulations*: Cooling water for industrial applications represents one of the larges water uses in the U.S. (USEPA). The most intensive use is for once-through cooling, in which water is used to cool heat-generating equipment; significant savings can be gained by recycling the water with a recirculating cooling system.

- *Capacity buy-back for process improvements*: A low-interest or grant program could be established for water suppliers to buy back water supply capacity from large users who install water-efficient fixtures and equipment, with payment to business based on avoided expansion costs.

Industrial and Thermoelectric Water Conservation in Other States

Of all water conservation practices, those specific to industrial water conservation are the least likely to be required by statute because there is tremendous variability among industries in terms of how water savings can be accomplished.

Arizona

The Ground water Code requires the Department to establish conservation requirements based on the use of the latest commercially available conservation technology consistent with reasonable economic return. (A.R.S. § 45-0566(A)(2)) All industrial users are required to avoid waste and make efforts to recycle water. Single-pass cooling or heating is not allowed unless water is reused, and low-flow plumbing fixtures are required as state or local plumbing codes mandate. (Since January, 1994, statewide plumbing code has required the use of low-flow plumbing fixtures in new construction throughout the state.) During the third management period, industrial users are required to use low water use landscaping plants where feasible and to water with efficient irrigation systems. Specific conservation requirements have been established for the following industrial uses:

- Turf-related facilities;
- Sand and gravel facilities;
- Large-scale power plants;
- Large-scale cooling facilities;
- Dairy operations;
- Cattle feedlot operations;
- New large landscape users;
- Metal mining (in all active management districts except Phoenix); and
- New large industrial users.

California

Through its Commercial, Industrial, and Institutional Program, the Office of Water Use Efficiency disseminates information on improved water use efficiency technologies to help develop and implement water use efficiency programs with local agencies. This includes financial assistance for development and implementation of water and energy efficiency programs.

Massachusetts

Please see Commercial/Institutional Water Conservation, above.

North Carolina

Please see Commercial/Institutional Water Conservation, above.

Summary of Industrial and Thermoelectric Water Conservation in Other States

Not all of the states surveyed have developed water conservation standards specific to industrial facilities. The examples above indicate that the key to industrial water conservation is to develop industry-specific and site-specific practices, or to require that water conservation practices be established to the greatest extent possible, based on technical and economic feasibility.

Agricultural Water Conservation

Appropriate practices for agricultural water conservation are site specific to some degree, but certain fundamental practices can result in predictably significant water savings, such as water metering, drip irrigation, and use of cover crops and mulches.

- *Metering requirements:* Metering is often the first step in an agricultural water conservation and efficiency program because knowledge of baseline water use is important for assessing the effectiveness of water saving efforts.

- *Use of Best Management Practices (BMPs)*: Best Management Practices are a collection of methods, procedures, techniques, or use of technology that are widely accepted as beneficial in achieving specific or general goals. Best Management Practices for water conservation might include irrigation scheduling parameters, the use of micro-irrigation, mulches and/or cover crops, timers, automatic shut-off valves, and many other water-saving methods.

- *Requirement/technical support for the use of reclaimed water*: Although reclaimed water is generally prohibited for use on food crops, it can be a feasible alternative to potable water for non-food crops.

- *Auditing and technical support for adoption of water-efficient technologies*: A common deterrent to the use of water conservation practices is lack of data regarding current water use and the potential of water-saving improvements. Like industrial water conservation, agricultural conservation potential may be site-specific and thus warrant on-site auditing and feasibility assessment of new technologies. Mobile Irrigation Labs (MILs) are used in some states to provide such assistance to agricultural producers.

- *Demand-dependent irrigation*: A crop demand-dependent irrigation schedule could be incorporated, based on parameters such as soil type, precipitation, and crop needs.

- *Efficiency workshops*: Agricultural water users could be educated on new technologies and techniques that can produce water savings.

Agricultural Water Conservation in Other States

Agricultural water conservation practices adopted by other states are quite varied but tend to include certain management practices.

Arizona

Arizona established Active Management Areas to address the depletion of ground water supplies, which has been a growing concern since the 1950s. Progressively stringent conservation practices are required in plans that correspond to five management periods, beginning in 1980 and continuing until 2025.

Within Arizona's Active Management Areas, irrigation is limited to acreage that has been historically irrigated unless a landowner obtains a "Certificate of Grandfathered Right," and all irrigation within these areas is subject to conservation requirements developed by the Arizona Department of Water Resources. Within Irrigation Non-expansion Areas, irrigation is also limited to historically irrigated acreage, but landowners are not required to comply with the conservation practices expected within Active Management Areas.

Agricultural conservation practices generally must meet an annual irrigation allotment, based on the annual irrigation requirements of the crops grown on the farm between 1975 and 1980 ("water duty"), the highest number of acres which were legally irrigated during any one year between 1975 and 1980 ("water duty acres"), and an irrigation efficiency requirement assigned by the Department. Farmers are allowed to use this allotment to irrigate any acres that were irrigated with any water at any time between 1975 and 1980. With each successive management area plan, the efficiency requirement calls for greater conservation efforts. Farmers are required to stay within their annual ground water allotments, but they are not required to use any specific conservation technologies. They may plant crops that require less water than those historically grown, plant fewer acres, employ more efficient irrigation practices, or manage water withdrawals judiciously through "flexibility accounts." Flexibility accounts allow farmers to accrue ground water allotment credits when less than the annual allotment is used. Credits registered in the preceding calendar year may also be sold to another farmer within the same ground water subbasin.

The third management plan (2000-2010) has been modified to include a Best Management Practices Program, which provides an alternative to the base allotment program. This program allows ground water users to implement specific conservation practices in lieu of complying with an irrigation water duty allotment. If this alternative is chosen, the water user must achieve conservation at least equivalent to the conservation required by the water duty allotment.

California

California's Agricultural Water Conservation and Management Act of 1992 (CA Water Code §§ 10521 et seq.) authorizes any public agency that supplies water for agricultural use to institute water conservation or efficient management programs. Such programs may include informational and consulting services regarding irrigation techniques, crop water use, improving water delivery systems, financial assistance to farmers, water-use monitoring, and conservation pricing structures.

The Agricultural Water Suppliers Efficient Water Management Practices Act (CA Water Code § 10900) requires the Department of Water Resources to periodically review potential efficient water management practices to determine which are feasible to achieve water conservation. In addition, the Department is to provide technical consultation and training in methods to deliver water to farmers based on their actual water needs, evaluate and recommend improvements regarding the uniformity of water application, optimum quantities and timing of application, and technologies and methods for improving water-use efficiency. To assist in carrying out these duties, the Department shall establish an advisory committee and consult with the committee on reviews and studies.

California also promotes agricultural efficiency through the use of Mobile Irrigation Laboratories (MILs), which evaluate the performance of irrigation systems for large irrigators. Technical assistance includes providing workshops and instruction on measurements of water application rates and system distribution uniformity, and recommendations for system improvements. The Department of Water Resources is currently serving larger irrigators but is attempting to expand service to small farms and landscape water users.

The Office of Water Use Efficiency Programs encourages agricultural irrigation efficiency through the Agricultural Water Use Program, which disseminates and transfers information on improved irrigation technologies, and the California Irrigation Management Information System (CIMIS). This program manages more than 125 automated weather stations statewide. It was developed in 1982 to help irrigators manage water resources more efficiently. Information provided by the weather stations is used for estimating crop water use for irrigation scheduling.

Florida

Mobile Irrigation Laboratories, typically consisting of one or two irrigation professionals, a vehicle, and equipment used for evaluating irrigation systems, provide education and technical assistance to irrigation system operators. MIL teams evaluate existing water use, identify potential conservation opportunities, and provide technical guidance on improving water delivery efficiency. The Southwest Florida Water Management District established the first MILs in Florida in 1986, and there are currently 15 labs providing irrigation services in 36 counties. Six MILs provide services to both agricultural and urban water users. Funding for the MILs is not centralized, but comes from a variety of sources, including the USDA-Natural Resources Conservation Service (NRCS), county

governments, water management districts, the Florida Department of Environmental Protection, the Florida Department of Community Affairs, and the National Estuary Program.

Each water management district has adopted rules and developed programs for water conservation and efficiency. In the Southwest Florida Water Management District, many agricultural operations are required to have a Water Use Permit from the water management district, which has specific provisions for maintaining a water budget and implementing conservation practices. Those operations not required to be permitted must either register the use of an alternative irrigation program, such as a published Best Management Practices document, or implement the following water conservation practices:

- All watering must occur before 10:00 a.m. or after 4:00 p.m., except:
    - Use of micro-irrigation and other low-volume irrigation methods is not restricted;
    - Operation of an irrigation system for plant protection, including prevention of heat stress or frost/freeze damage, is not restricted; and
    - Insecticides and other chemicals can be watered in according to the manufacturer's instructions and as required by law.

North Carolina

North Carolina's Division of Water Resources rules require that users of water for irrigating agricultural crops or forestry stock must provide information on acreage irrigated, types of crops that must be irrigated, method of irrigation, and a statement that the applicant uses conservation practice standards for irrigation as defined by the [U.S. Department of Agriculture] Natural Resources Conservation Service.

Technical assistance for increasing water use efficiency is offered through a variety of organizations, including the Natural Resource Conservation Service, the Soil and Water Conservation Districts, the Agricultural Extension Service, the North Carolina Agricultural Cost Share Program, and the Division of Pollution Prevention and Environmental Assistance. By simply tracking water use and making adjustments to reduce waste, one livestock operation reduced water use by 38 percent.

Texas

Agricultural water conservation in Texas is based primarily on the voluntary implementation of best management practices, however, large irrigators are required by Senate Bill 1 (1997) to develop and implement water conservation and drought contingency plans. Senate Bill 1 also allowed local authorities to grant property tax exemptions for water conservation practices, and allowed the Texas Water Development

Board to use principle from the Agricultural Trust Fund to provide financial incentives and/or low-cost loans for the installation of agricultural water conserving devices.

In 2003, Senate Bill 1053 consolidated certain existing financial assistance programs for agricultural conservation and authorized the Texas Water Development Board to provide financial assistance to demonstration projects, technology transfers, and educational programs.

Summary of Agricultural Water Conservation in Other States

Agricultural water conservation in the states surveyed is based primarily on the adoption of best management practices, adherence to water budgets, and/or site-specific technical assistance and training. Water budgets may be based on the types of crops irrigated, historical water use, regional conservation goals, and other parameters. Two states (California and Florida) improve irrigation efficiency through the use of mobile irrigation laboratories, which help irrigation system operators evaluate the potential for water savings. The other states provide irrigation efficiency assistance through other types of state agency activities.

Chapter 4

CONCLUSIONS

Georgia enjoys a relatively plentiful water supply, yet the availability of our water resources varies both seasonally and regionally. When our natural water complexity is considered with regard to increasing water demands, it becomes apparent that Georgia must approach water management in a thoughtful, comprehensive and coordinated manner based on the best science we have.

The legal foundation upon which water management in Georgia rests is the set of statutes enacted by Congress and the Georgia General Assembly. Collectively, this body of law has set two general water-related goals for us to meet:

- Protect public health and environmental quality; and

- Meet future needs while protecting aquifers, instream uses and downstream users.

We face significant challenges, however, in meeting these goals. First, inconsistencies and lack of coordination can hamper meeting at least some of our goals. Laws are passed by different legislative bodies at different times, with different motivations, and for different purposes. They are implemented by federal and state agencies with varying degrees of financial, technical, and managerial capacity. Specific water-related decisions reflecting policies and programs are made by local government officials, private sector institutions, and the general public. Assuring coordination and avoiding inconsistencies in such a situation may be desirable but rarely occurs, at least to the extent necessary to fully meet the goals of the statutes.

A second challenge in meeting our water goals is that laws are not static. They reflect the values we attribute to water resources at a particular point in time. These laws also reflect the world as we know it—or can reasonably expect it to become—at the point in time when we conceive them. Congress and the General Assembly can amend these statutes, but they do not always change in lock step with a shift in citizens' goals, aspirations, perceptions, activities, and knowledge related to water resources.

To better address the water challenges we face, the Comprehensive State-wide Water Management Planning Act was passed by the Georgia General Assembly during the 2004 legislative session. This law directs the Environmental Protection Division of the Georgia Department of Natural Resources to develop a comprehensive state water management plan and creates the Georgia Water Council composed of legislators, legislative appointees and agency heads with water-related responsibilities to oversee the development of the plan. The plan is to be provided to the Council in July 2007 for its review and adoption and presented to the General Assembly for consideration in the 2008 legislative session.

The first iteration of the comprehensive water management plan will focus on four key policy objectives:

1. Minimizing withdrawals of water by increasing conservation, efficiency, and reuse;

2. Maximizing returns to the basin through reducing interbasin transfers and limiting use of septic tanks and land application of treated wastewater where water quantity is limited;

3. Meeting instream and offfstream water demands through storage, aquifer management and reducing water demands; and

4. Protecting water quality by reducing wastewater discharges and runoff from land to below the assimilative capacity of the streams.

This report is the first of four policy documents to focus on these objectives; specifically on increasing water conservation, efficiency, and reuse.

Although we have enjoyed a generally plentiful supply of water, conservation, efficiency, and reuse efforts are already widespread in the state. This is due to a variety of factors, including the economic and environmental benefits resulting from making better use of available water and requirements such as restrictions on outdoor watering. The basic question relating to water conservation is whether the current efforts are sufficient or should the state adopt a more focused and better coordinated approach to conserve water. If a more concerted water conservation effort is necessary or desirable, a variety of practices must be available for use by the appropriate water using sectors. In addition, flexibility is needed to allow for the use of policy options that are appropriate in a given situation. The result will be that approaches may vary from region to region depending on water resources and demands, but that all regions will be consistent with the overall state water policy framework.

The water we have is the least expensive water we can use and if we use it more wisely and use it over again, we will reduce the demands on our water resources for increased withdrawals. However we look at it, water conservation is an objective that will nearly always pay for itself, resulting in a less expensive way of doing what we do and providing environmental and quality of life benefits at the same time.

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APPENDICES

Appendix A

WATER CONSERVATION IN SELECTED STATES

Arizona

As an arid state, Arizona has practiced water management for decades. The Colorado River provides much the of water used for municipal and agricultural purposes: the Central Arizona Project, a 336-mile canal system, carries 1.5 million acre feet of Colorado River water to interior parts of the state while 1.3 million acre feet of Colorado River water is used by Arizonans along the river (Frank). Arizona has constructed surface water reservoirs and delivery systems throughout the state, with almost all of it natural surface water developed for human use. Arizona's surface water provides for 60 percent of water demands, while ground water supplies the remaining 40 percent. The vast majority (80 percent) of water supplies are used for agricultural irrigation, although the percentage of water used for agriculture is gradually decreasing as residential communities replace farmland in suburban areas.

Agency Responsibility for Water Use Management and Conservation

The **Arizona Department of Water Resources** is the primary state agency involved with water conservation efforts, as the agency that administers and enforces ground water and surface water laws (except those related to water quality). Other state organizations involved with water conservation are the **Arizona Municipal Water Users Association** (AMWUA) and the **Arizona Corporation Commission** (ACC). The Arizona Municipal Water Users Association is a non-profit organization that represents nine Phoenix area municipalities in water management matters that require a coordinated effort. The Arizona Corporation Commission is the equivalent of most states' Public Service Commission or Public Utility Commission, except that its roles go beyond traditional public utilities regulation (and include facilitating the incorporation of businesses and organizations, securities regulation, and railroad/pipeline safety).

Statutory Framework for Water Conservation in Arizona

Regulation of Arizona's water resources began in 1980, when the Arizona Legislature passed the **Ground water Management Act** to address ground water depletion that had been a growing concern since the 1950s. Arizona's primary focus has been and continues to be the protection of ground water stores within active management areas of the state (see below) in favor of renewable surface supplies. The Ground water Management Act contained two primary provisions: the need to demonstrate a 100 year assured water supply for all new subdivisions and to achieve mandatory conservation requirements for ground water users in the municipal, industrial, and agricultural sectors. (Frank)

The Ground water Management Act called for the Arizona Department of Water Resources (henceforth referred to as the "Department") to implement its provisions and,

through the Arizona Ground water Code (A.R.S. § 45-401 through § 45-704), established four Active Management Areas (AMAs): Phoenix, Pinal, Prescott, and Tucson. A fifth active management area, Santa Cruz, was formed in 1994 from the southern portion of the Tucson management area. The active management areas and the programs they adopt have been quite significant because 80 percent of Arizona's population lives within an active management area, and until recent years, the only conservation programs in the state applied to residents of active management areas. In addition to the active management areas, the Act established two Irrigation Non-Expansion Areas, with a third area designated since its passage. Agricultural irrigation in these areas, while not as closely regulated as the management areas, is limited to acreage that has historically been irrigated.

In recent years, Arizona has been faced with prolonged drought conditions that caused declines in surface water supplies, which, in turn, led to renewed reliance on ground water. Faced with already unsustainable levels of ground water demand and a growing population, state water managers have turned to water conservation as a central component of the state's water planning efforts. In March, 2003, Governor Janet Napolitano signed an executive order (#2003-12) that, in addition to specific drought-related actions, called for the establishment of the Governor's Drought Task Force. The Governor's Drought Task Force, under the leadership of the Department, completed the Arizona Drought Preparedness Plan. This Plan is comprised of three elements: the Background and Impact Assessment, the Operational Drought Plan, and a Statewide Water Conservation Strategy. These documents identify existing drought vulnerabilities and responses, as well as a drought monitoring system and response implementation for future droughts.

Active Management Areas

Note: This section describes the conservation programs in Active Management Areas. Many other water management programs exist.

Municipal Water Conservation in Active Management Areas

Municipal water providers within the active management areas are required to develop and implement water conservation programs subject to requirements established by management plans developed by the Department for each active management area. Progressively stringent conservation practices are required in plans that correspond to five management periods, beginning in 1980 and continuing until 2025. For three of the management areas, Phoenix, Prescott, and Tucson, the ultimate goal is to achieve safe yield (withdrawing no more ground water than is replenished either naturally or artificially) by 2025 or earlier and prevent local declines in aquifer levels. In the Pinal management area, where agriculture dominates, the goal is to allow the development of non-irrigation water uses, maintain an agricultural economy as long as possible, and preserve water supplies for future non-irrigation uses. The goal for the Santa Cruz management area is to maintain safe yield and prevent long-term declines in local water levels.

The *first management plans* (1980-1990) initiated basic water management programs through mandatory conservation requirements for major water users within the active management areas. The plans were required by statute to focus on per capita (gallons per capita per day) water use reductions. A total per capita use program was established as the base program for all municipal water providers. The higher the base year per capita rate, the higher the required reduction in per capita use, thus rewarding providers who had already attained low per capita usage. The 1980 population census and total water use were used to calculate each water provider's base year per capita rate.

The *second management plans* (1990-2000) established more comprehensive and aggressive conservation requirements, along with a water supply augmentation program to reduce reliance on ground water sources. These plans recognized the unique characteristics of various service areas and focused on analysis of the conservation potential for each service area, using 1985 as the base year. A single total per capita use requirement was established for each large municipal provider, with intermediate levels established for 1992 and 1995 and achievement of the final per capita use requirement expected by 2000. An alternative to the per capita use requirements is a program implemented in 2004, the "Alternative Municipal Conservation Program," (ACP) which allows the implementation of a residential gallon-per-capita-per-day requirement and best management practices for the non-residential sector. This program is expected to achieve conservation savings at least equivalent to the Total Gallons Per Capita Per Day Program. The Department also adopted the Conservation Assistance Grants Program in the second management period to provide financial, planning, technical, and other support services.

The *third management plans* (2000-2010) continue and refine mandatory conservation requirements and continues to encourage the use and storage of renewable supplies. During this management period, the Department is required to develop specific management tools, including the following:

- Maintain Second Management Plan conservation efforts which were effective, expand them where appropriate, and recognize existing conservation efforts;
- Provide financial and technical assistance to implement water conservation;
- Expand public assistance and public education efforts;
- Provide incentives to encourage water conservation;
- Take maximum advantage of excess renewable water supplies while the opportunities exist;
- Actively participate in regional and local water management planning; and
- Encourage recharge activities in areas where storage of renewable supplies will be beneficial from a water management perspective.

Mandatory conservation requirements were established for agricultural, municipal, and industrial ground water users and ground water distribution systems. Mandatory conservation requirements were also established for agricultural, industrial, and distribution systems in the first and second management plans. A second alternative program to the Gallons Per Capita Per Day Program was established for municipal water providers in this management plan. It was the Non Per Capita Conservation Program. It established a set of standard residential, non-residential, and educational Reasonable Conservation Measures (RCMs) with the aid of an advisory group of conservation program experts from the regulated community. Each conservation measure describes an action that must be taken by the water provider to achieve efficiency in each water use sector. The number of measures required of a water provider is dependent on the current per capita use rate and the service area's conservation potential.

Reasonable Conservation Measures include interior and exterior water audits; plumbing requirements and retrofit programs; prohibitions of covenants that require water-intensive landscaping or prohibit the use of low water use landscaping; landscape watering advice programs; and public information and education programs.

Industrial Conservation in Active Management Areas

The Ground water Code requires the Department to establish conservation requirements based on the use of the latest commercially available conservation technology consistent with reasonable economic return. (A.R.S. § 45-0566(A)(2)) All industrial users are required to avoid waste and make efforts to recycle water. Single-pass cooling or heating is not allowed unless water is reused, and low-flow plumbing fixtures are required as state or local plumbing codes mandate. (Since January, 1994, statewide plumbing code has required the use of low-flow plumbing fixtures in new construction throughout the state.) During the third management period, industrial users are required to use low water use landscaping plants where feasible and to water with efficient irrigation systems. Specific conservation requirements have been established for the following industrial uses:

- Turf-related facilities;
- Sand and gravel facilities;
- Large-scale power plants;
- Large-scale cooling facilities;
- Dairy operations;
- Cattle feedlot operations;
- New large landscape users;

- Metal mining (in all active management districts except Phoenix); and
- New large industrial users.

Agricultural Water Conservation and Flexibility Accounts

Within active management areas, no new irrigation acreage is allowed. Irrigation is permitted only if a landowner obtains a "Certificate of Grandfathered Right," and all irrigation within active management areas is subject to conservation restrictions required by statute to be developed by the Department. (Agricultural landowners within Irrigation Non-expansion Areas must obtain a "Notice of Irrigation Authority," which generally does not entail the conservation elements required within active management areas. In the remainder of the state, farmland can be irrigated without a grandfathered right or irrigation authority, and water use is generally not restricted or metered.) (Frank)

For active management areas, the Ground water Code requires that the Department "…assume the maximum conservation consistent with prudent long-term farm management practices within areas of similar farming conditions, considering the time required to amortize conservation investments and costs." In order to implement this requirement, the Department assigns each farm in a management area a maximum ground water allotment. This allotment is based on the annual irrigation requirements of the crops grown on the farm between 1975 and 1980 ("water duty"), the highest number of acres which were legally irrigated during any one year between 1975 and 1980 ("water duty acres"), and an irrigation efficiency requirement assigned by the Department. Farmers are allowed to use this allotment to irrigate any acres that were irrigated with any water at any time between 1975 and 1980. With each successive management area plan, the efficiency requirement calls for greater conservation efforts. Farmers are required to stay within their annual ground water allotments, but they are not required to use any specific conservation technologies. They may plant crops that require less water than those historically grown, plant fewer acres, employ more efficient irrigation practices, or manage water withdrawals judiciously through "flexibility accounts." The third management plan has been modified to include a Best Management Practices Program, which provides an alternative to the base allotment program.

Flexibility accounts were established by the Department to allow farmers to accrue ground water allotment credits when less than the annual allotment is used. In 1991, the Arizona Legislature amended the flexibility account statutes to allow credits registered in the preceding calendar year to be sold to a farmer within the same irrigation district. This was further extended in 1998 to allow credits to be sold to another farmer within the same ground water subbasin.

The third management plan was modified in 2004 to include an Agricultural Best Management Practices Program, which allows ground water users to implement specific conservation practices in lieu of complying with an irrigation water duty allotment.

(A.R.S. § 45-566.02(F)) If this alternative is chosen, the water user must achieve conservation at least equivalent to the conservation required by the water duty allotment.

Arizona Statewide Water Conservation Strategy

The emphasis of the Arizona Statewide Water Conservation Strategy is on developing a statewide "water conservation ethic" among municipalities, water providers, with special focus on encouraging conservation in rural communities outside of management areas. Recommendations of the strategy include the following key elements:

- Create a statewide conservation office to implement new conservation programs;
- Secure a dedicated funding source for the conservation office and programs
- Create a state sponsored conservation web site;
- Develop conservation benchmarks and goals at local levels;
- Create conservation incentives and education programs;
- Adopt and promote recommended water conservation measures ("Water Conservation ABCs");
- Expand public messaging campaign; and
- Provide technical assistance for leak detection and auditing programs.

Local Conservation Efforts

Many communities, both within and outside of management areas, have developed aggressive local conservation programs. In Phoenix, where residential use dominates water demand, residential programs such as seasonal rate variations, low-flow plumbing fixture codes and retrofits, water audits, public education, and technical assistance have resulted in savings, as of 2002, of 40 million gallons per day (mgd).The City of Gilbert has instituted a multifaceted program that includes reuse of reclaimed water, building code requirements, a low water-use landscaping program, an increasing block rate structure, public education, and a wastewater recharge system that has freed 5 billion gallons of water for recreation, wildlife habitat, and ground water recharge (Task Force Conservation Strategy). Tucson has codified several aspects of its conservation program with ordinances regulating water waste, Xeriscaping, low-flow plumbing fixtures, and emergency conservation.

Success of Water Conservation Efforts in Arizona

Arizona's ground water use has decreased significantly from 1975 to 2000. In some areas, this is due to greater reliance on surface water, especially Central Arizona Project

water from the Colorado River. In other areas, it is due to a reduction in the amount of acreage being farmed. In Maricopa County, for instance, the amount of irrigated farmland fell 35 percent from 1985 to 2000, from 389,000 acres to 251,000 acres (Frank). Agricultural water use has been reduced significantly by land being retired from agricultural production as suburban development replaces agriculture. In general, Arizona's municipal conservation efforts have been more successful than its efforts to increase efficiencies in the agricultural or industrial sectors.

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California

Droughts that California experienced in 1975-1976 and 1987-1993 brought awareness of the need to use water efficiently, and since then, water conservation has become a way of life for most Californians, most of whom have easy and affordable access to a wide array of off-the-shelf water efficient plumbing fixtures, washing machines, landscape irrigation systems, and water-thrifty plants. (Todd)

Still, California has continuing challenges regarding water supply and demand: most annual precipitation occurs during winter months, while the greatest demand is in dry summer months. In addition, about 75 percent of precipitation falls north of Sacramento, yet more than 75 percent of demand is south of Sacramento. Surface water projects such as the Central Valley Project (CVP) and the State Water Project (SWP) provide a major portion of the state's supply. The state's surface water projects include more than 1,200 federal, state, and local reservoirs, as well as canals, treatment plants, and levees (2005 Water Plan Update highlights). Despite its conservation ethic and monumental efforts to provide adequate water resources for agricultural and municipal uses, California water planners estimate tremendous annual water shortages unless steps are taken to address declining reliability of the state's water supply system (OWUE, ACWA). Between 1990 and 2000, as a result of new regulations and laws, about one million acre-feet (about 326 trillion gallons) of water was reallocated from agricultural and municipal use to environmentally protective uses. However, infrastructure for replacing this water has not been developed, leaving a resource shortfall that is expected to increase as the population of California swells to a projected 46 million by 2020. (ACWA, May 2005)

Agency/Organizational Responsibility for Water Use Management

The **California Department of Water Resources** operates and maintains the State Water Project, including the California Aqueduct. The department also provides dam safety and flood control services, assists local water districts in water management and conservation activities, promotes recreational opportunities, and plans for future statewide water needs. (DWR)

The **Office of Water Use Efficiency (OWUE)** is responsible for water use efficiency planning and coordination throughout the state. It provides technical information and assistance to local agencies and individuals regarding agricultural and urban water and energy conservation, water reuse, and drainage management; conducts analysis and research; and provides loans and grants for water efficiency projects. The Office also manages the California Irrigation Management Information System (CIMIS) and assists in establishing mobile irrigation laboratories (see descriptions of these programs below). (OWUE)

The **California Urban Water Conservation Council** (CUWCC) was founded in 1991 to increase efficient water use statewide through partnerships among water agencies, public interest organizations, and private entities. A Memorandum of Understanding has been signed by 337 members, pledging to develop and implement comprehensive water

conservation Best Management Practices. The Council supports the water conservation efforts of its member organizations by providing training and technical assistance, monitoring and evaluating conservation programs and activities, assisting in implementing BMPs, producing and distributing water conservation literature, and through research and development projects. Signatory water suppliers submit standardized reports every other year to the Council, providing information to inform the council on progress being made toward the BMP process. (CUWCC)

The **Agricultural Water Management Council** was formed in 1996 to promote water use efficiency while maintaining and enhancing economic, social, and environmental sustainability of soil and crop production. The current Council consists of more than 50 agricultural water suppliers, 3 environmental interest groups, and 41 other interested (non-voting) parties. Participating water suppliers enter into a Memorandum of Understanding that includes a comprehensive methodology by which efficient water management practices are analyzed and implemented. (OWUE)

The **State Water Resources Control Board** was formed in 1956 with the merging of the regulatory functions of the State Water Quality Control Board and the State Water Rights Board. The Board's responsibility is to protect water quality of the state and to balance competing demands for water resources. Specifically, the Board allocates water rights, adjudicates water right disputes, develops statewide water protection plans, establishes water quality standards, and guides the nine Regional Water Quality Control Boards located in the major watersheds of the state. (Ground water is not regulated by California's permitting process, though by case law, it is held to the "reasonable use provision governing other types of water rights and in some basins, ground water use is regulated in accordance with court decrees. (SWRCB)

Statutory Framework for Water Conservation in California

The **Water Conservation Bond Law of 1988** (CA Water Code § 12879 et seq.) was enacted to provide state financial support for local water projects and programs, including voluntary water conservation programs and ground water recharge projects. The statute creates the 1988 Water Conservation Fund, in which state funds are allocated to the Local Water Projects Assistance Account and the Water Conservation and Ground water Recharge Account. Through these accounts, the Department of Water Resources may make loans to local agencies, upon approval by the legislature, to aid in the construction of projects and in funding of voluntary, cost-effective capital outlay water conservation programs and ground water recharge facilities. The Department may adopt rules and regulations as required to carry out these provisions. The sum of 20 million dollars ($20,000,000) was allocated for each account, with a maximum of five million dollars to be loaned to a local agency for an eligible project. Through the same accounts, local agencies may borrow up to five hundred thousand dollars ($500,000) for the purpose of financing feasibility studies of projects potentially eligible for funding pursuant to this statute.

The **Water Conservation in Landscaping Act of 1990** (CA Government Code §§ 65591-65600) required the Department of Water Resources, with the assistance of an advisory task force, to develop a model water efficient landscape ordinance. By no later than January 31, 1993, if they had not done so already, each local agency was required to file with the Department either a water efficient landscape ordinance or findings, based on water availability or climatic, geological, or topographic conditions, stating that such an ordinance is unnecessary. If a city or county failed to adopt an ordinance or submit findings by January 31, 1993, the model ordinance developed by the Department was to be enforced by the local agency. The model ordinance includes the following provisions:

- Water conservation through the appropriate use and groupings of plants that are well adapted to particular sites and conditions (however, ordinance may not prohibit or require specific species);

- Use of automatic irrigation systems and seasonal irrigation schedules incorporating conservation design, and utilizing design and irrigation methods that ensure a high degree of water efficiency;

- Grading and drainage to promote healthy plant growth and prevent excessive erosion and runoff;

- Use of recycled water supplied through dual distribution systems, if feasible and cost effective, and subject to appropriate health standards;

- Educate water users on the efficient use of water and the benefits of doing so;

- Address regional differences where necessary and feasible;

- Exempt landscaping which is part of a registered historic site, where feasible;

- Use of economic incentives to promote the efficient use of water; and

- Landscape maintenance practices which foster long-term landscape water conservation.

The **Agricultural Water Conservation and Management Act of 1992** (CA Water Code §§ 10521 et seq.) authorizes any public agency that supplies water for agricultural use to institute water conservation or efficient management programs. Such programs may include informational and consulting services regarding irrigation techniques, crop water use, improving water delivery systems, financial assistance to farmers, water-use monitoring, and conservation pricing structures.

The **Agricultural Water Suppliers Efficient Water Management Practices Act** (CA Water Code §10900) requires the Department of Water Resources to periodically review potential efficient water management practices to determine which are feasible to achieve water conservation. In addition, the Department is to provide technical consultation and

training in methods to deliver water to farmers based on their actual water needs, evaluate and recommend improvements regarding the uniformity of water application, optimum quantities and timing of application, and technologies and methods for improving water use efficiency. To assist in carrying out these duties, the Department shall establish an advisory committee and consult with the committee on reviews and studies.

California Urban Water Management Planning Act (CA Water Code §§10610 through 10657) adopted in 1983 and amended last in 2001, requires each urban water supplier to prepare an Urban Water Management Plan within one year after it has become an urban water supplier and update the plan at least once every five years on or before December 31, in years ending in five and zero. Plans must be filed within 30 days of adoption with the Department of Water Resources, the California State Library, and any city or county within which the supplier provides water supplies. Urban water management plans serve as long-range planning documents, provide source data for regional water plans and for cities' and counties' general planning efforts, and as a key component to Integrated Regional Water Management Plans (described below).

This statute affects all urban water suppliers, publicly or privately owned, who supply water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet annually (approximately 977 million gallons per year). The conservation component of the Urban Water Management Plans includes a description of each water demand management measure currently implemented or scheduled for implementation, including steps necessary to implement any proposed practices, including but not limited to the following:

- Water survey programs for single-family residential and multifamily residential customers;
- Residential plumbing retrofit;
- System water audits, leak detection and repair;
- Metering with commodity rates for all new connections and retrofits of existing connections;
- Large landscape conservation programs and incentives;
- High-efficiency washing machine rebate programs;
- Public information programs;
- School education programs;
- Conservation programs for commercial, industrial, and institutional accounts;
- Wholesale agency programs;

- Conservation pricing;
- Water conservation coordinator;
- Water waste prohibition; and
- Residential ultra-low-flow-flush toilet replacement programs.

In addition, the plan must include a description of method the water supplier will use to evaluate the effectiveness of water demand management practices, an estimate, if available, of existing conservation savings on water use within the supplier's service area, and the effect of the savings on the supplier's ability to further reduce demand. Any water demand management measure listed above that is not implemented or scheduled for implementation must also be evaluated.

Each urban water supplier shall coordinate the preparation of its plan with other appropriate agencies in the area to the extent practicable, including water suppliers that share a common source. Suppliers may satisfy requirements of this statute by participating in areawide, regional, watershed, or basinwide urban water management planning where those plans will reduce preparation costs and contribute to the achievement of conservation and efficient water use. (CA Water Code **§** 10610 (d)(1),(2))

Urban Water Management Plans are reviewed by the Department of Water Resources for completeness according to the Urban Water Management Planning Act. Plans are required in order for water suppliers to be eligible for Department administered state grants and loans and drought assistance. Each supplier pays for the preparation of their Urban Water Management Plan. The Department of Water Resources provides technical assistance for urban suppliers seeking to comply with the Act.

The **Integrated Regional Water Management Act** (CA Water Code Div. 6/Part 2.2 **§§** 10530-10546) adopted in 2000, encourages local governments to work cooperatively to manage their water resources by allowing a regional water management group to prepare and adopt an Integrated Regional Water Management Plan that includes certain qualified programs, projects, or studies. Many of the elements identified for use in these plans are also part of an Urban Water Management Plan. State financial assistance for preparation and implementation of the plans is administered by the Department of Water Resources and the State Water Resources Control Board. Regional water plans serve as a framework for agencies to integrate programs and projects that protect and enhance the quality and quantity of regional water supplies, as well as providing economic, environmental, and flood control benefits. (DWR UWMP Guidebook)

Assembly Bill 1561 (2002) requires all residential clothes washers to be at least as efficient at commercial washers beginning in January 2007.

Water Reuse Statutes

Ground Water Management Plans are required by California Water Code (Sections 10750-10755.4). One of the technical requirements of the statute gives local agencies responsibility for construction and operation of ground water cleanup projects, recharge, storage, conservation, water recycling, and extraction projects. (Todd)

The **Water Recycling Act of 1991** (California Water Code §13577) made legislative findings regarding the environmental benefits and public safety of using recycled water as a reliable and cost-effective method of helping to meet California's water supply needs. The statute sets a goal 700,000 acre-feet (approximately 228 trillion gallons) of recycled water to be used annually by the year 2000.

In 2000, the **Water Recycling in Landscaping Act** required that any local public or private entity that produces recycled water and determines that within 10 years it will provide recycled water within the boundaries of a local agency, to notify the local agency of that fact. In tern, local agencies are required to adopt and enforce a recycled water ordinance.

Other Water Conservation Initiatives

The California Water Plan

The California Water Plan, first developed in 1957, was updated in 2005, addressing water management to 2030. The 2005 plan acknowledges that water resource management will depend on many variables, including population trends, demand trends, climate change, and variations in demand from region to region and sector to sector, and that no single water management strategy will work statewide. This water plan update describes 25 resource management strategies to be used as a toolkit, with tools being used in combinations that depend on individual situations faced by different regions.

The foundation for water management in the current planning period will be threefold: to use water efficiently, to protect water quality, and to manage water in ways that protect and restore the environment. Efficiency practices will include the following components:

- Increase levels of urban and agricultural water use efficiency;
- Increase recycled municipal water and expand its uses;
- Reoperate water facilities to improve their operation and efficiency;
- Facilitate environmentally, economically, and socially sound transfers to avoid regional shortages; and
- Reduce and eliminate ground water overdraft.

Department of Water Resources Programs

Mobile Irrigation Laboratories (MILs) evaluate the performance of irrigation systems for large irrigators. Technical assistance includes providing workshops and instruction on measurements of water application rates and system distribution uniformity, and recommendations for system improvements. DWR is currently serving larger irrigators but is attempting to expand service to small farms and landscape water users. (DWR)

Leak detection and repair: The Department of Water Resources and the California Urban Water Conservation Council frequently co-sponsor workshops on methods and software to assist water suppliers in leak detection and repair.

Office of Water Use Efficiency Programs

Landscape Water Use Program: The Office collects and maintains data related to landscape acreage and water use, promotes water budget irrigation scheduling, develops Geographic Information System (GIS) products for the Web to promote landscape water use efficiency, coordinates with the California Urban Water Use Council to support best management practices for large-landscape irrigation, and develops water efficient landscape projects in cooperation with local, state, and federal agencies. Current programs include working to promote the use of water-efficient landscapes and irrigation systems and evapotranspiration-based irrigation schedules. (OWUE)

Agricultural Water Use Program: The Office disseminates and transfers information on improved irrigation technologies to identify and help develop technologies and farming methods that improve water use efficiency (Ibid).

Commercial, Industrial, and Institutional Program: The Office disseminates information on improved water use efficiency technologies to help develop and implement water use efficiency programs with local agencies. This includes financial assistance for development and implementation of water and energy efficiency programs.

California Irrigation Management Information System (CIMIS): This program manages more than 125 automated weather stations statewide. It was developed in 1982 to help irrigators manage water resources more efficiently. Information provided by the weather stations is used for estimating crop water use for irrigation scheduling. (Ibid).

California Urban Water Conservation Council (CUWCC)

The Water Council was created in 1991, in the midst of a 6-year drought in California, as a governing body and overseer of water conservation. Signatories, including water suppliers, environmental/public advocacy organizations, and other interested groups, entered into a Memorandum of Understanding that focuses on a set of best management practices (BMPs) intended to reduce the long-term urban demands on water supplies. The Water Council today has 337 signatories: 189 water suppliers that represent more than 70 percent of California's water deliveries; 30 environmental/public advocacy groups; and

118 groups representing interested parties. (This group does not vote on BMPs, whereas the other two categories of groups do.) Signatory water suppliers must submit standardized annual reports every two years to the Water Council so that the progress of implementing BMPs can be assessed. The term of the initial MOU was ten years, from 1991 to 2001, and thereafter, it is automatically renewed unless a signatory withdraws.

Sub-state Water Conservation and Reuse Efforts

In 1992, Santa Monica's city council initiated the Sustainable City Program, consisting of five major policy areas, including resource conservation. This policy area encompasses water, energy, recycling, and waste management. As part of this effort, the city has instituted a number of water conservation policies, including the following (EPA 2002):

- No water waste ordinance;
- Plumbing code;
- Water conserving landscape regulations;
- Water demand mitigation fee;
- Wastewater mitigation for large development projects;
- Retrofit-upon-resale ordinance; and
- Water and wastewater rate structure.

Programs implemented by the city include the following (Ibid):

- Residential water-use surveys;
- Commercial and industrial water-use surveys;
- Demonstration sustainable gardens;
- Sustainable landscape workshops and garden tours;
- Sustainable landscape guidelines;
- California irrigation management information system;
- Bay Saver Toilet Retrofit Program; and
- Water Efficiency Revolving Loan Program.

The Irvine Ranch Water District is experimenting with Evapotranspiration (ET) Controllers, weather-controlled irrigation systems. These systems have been installed at 40 homes, and consumption dropped by 17 percent and runoff was cut in half. (Todd)

Success of Water Conservation Efforts in California

Californians have made great progress on urban water use efficiency over the past few decades. As has been demonstrated in various regions of the state, an increase in population does not necessarily result in a proportionate increase in urban water use. For example, the Los Angeles Department of Water and Power Reports in their Urban Water Management Plan Update 2002-2003 that "water conservation continues to play an important pat in keeping the city's water use equivalent to levels seen 20 years ago." While some regions of the state cannot claim such progress, this report indicates that indeed something is working well in the field of water use efficiency. Credit for some of these improvements can be given in part to the implementation of water use efficiency that has been institutionalized through the California Urban Water Conservation Councils' Memorandum of Understanding (MOU). This involves the active participation and united effort of urban water agencies, environmental interests, and the business community. While the council is considering more BMPs, there are other activities that could contribute toward improved water use efficiency, including new methods and technologies that can be expected to significantly increase conservation potential. (Todd)

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Florida

Florida has a long history of water management, based in large part on the 1973 Florida Water Resources Act (Chapter 373, F.S.), which focuses, among other things, on water resource planning, water use permitting, and the management and storage of surface waters. This Act created five water management districts that were given, under the guidance of the state Department of Environmental Protection, responsibilities for regional water resource management. In 1976, a constitutional amendment strengthened the districts' capabilities by giving the districts the authority to levy property taxes to help fund water management activities.

Each water management district – the Northwest Florida Water Management District (NWFWMD), the St. Johns River Water Management District (SJRWMD), the South Florida Water Management District (SFWMD), the Southwest Florida Water Management District (SWFWMD), and the Suwannee River Water Management District (SRWMD) – has been charged with creating and maintaining a detailed water supply plan, including water conservation and reuse elements.

Florida's water management districts are required by Chapter 62-40, F.A.C. (see below), Water Resource Implementation Rule, to designate water resource caution areas (WRCAs), which have or expect to have critical water supply problems during the next 20 years. Within these zones, conservation, reuse, and the use of alternative water supplies are especially important, and water management requirements are generally more stringent within these areas. The entire eastern coast of Florida is designated as a water use caution area, as well as most of the southern half of the state.

Water Reuse

Florida is a national leader in terms of water reclamation and reuse, signified by a statewide slogan, "Use it Again, Florida!" Reuse has been identified as a critical element in Florida's ability to meet future water needs, and is an integral part of the state's water conservation strategy. In the mid-1980s, the Department of Environmental Protection began development of a comprehensive Water Reuse Program, and by the late 1980s, several laws had been passed to govern and encourage its proliferation. Reuse is specifically encouraged and promoted by statute and the 2001 Florida Water Plan, and as of recent amendments to the water code (Chapter 62-40), water reuse is required statewide unless it is economically, environmentally, or technically unfeasible. (Trimble)

As of 2003, when water reuse facilities were inventoried (DEP 2004), Florida had a total of 469 domestic wastewater treatment facilities with permitted capacities of 0.1 million gallons per day (mgd) or above that make reclaimed water available for reuse. These facilities serve 436 reuse systems which, combined, have a capacity of 1,206 mgd, with 603 mgd used for beneficial purposes at the time of the survey. Some reuse systems use other sources of water to augment the reclaimed water supply (from surface water, ground water, stormwater, and drinking water, totaling less than 20 mgd as of 2003). An additional .25 mgd was retrieved from aquifer storage and recovery systems (ASR) to

supplement reclaimed water. Reclaimed water is used in Florida primarily for irrigation (golf courses, residential, public access areas, and agricultural crops, both edible and nonedible), with other uses as ground water recharge, indirect potable use, industrial purposes, and wetlands restoration. (DEP Supply Plans, 2004) In 2005, amendments to Chapter 62-40, F.A.C. encourage reuse that gives priority to uses of reclaimed water that most significantly reduce the use of potable water, or that result in a higher proportion of water going to recharge a potable quality aquifer that is used for public water supply or a potable quality surface water.

Florida Water Supply/Conservation Organizations

Florida Department of Environmental Protection

The DEP is Florida's lead agency for environmental management. It administers regulatory programs and issues permits for the stewardship of land, air, and water resources. The Division of Water Resources Management coordinates activities of Florida's five water management districts, including state-wide and regional water planning efforts, conservation and reuse, water resource protection and enhancement, and alternative water supply development. It also administers state and federal funding programs that can be used for water conservation and reuse projects and programs.

Water Management Districts

Water management districts are responsible for designating water resource caution areas, issuing permits, establishing minimum flows and levels to protect ground and surface waters from over-withdrawals (§§ 373.042 and 373.0421, F.S.) and other water quality issues. One of the key roles of the five water management districts is to regulate water through consumptive use permits issued with the intention of ensuring that water use is consistent with district and DEP objectives and is not harmful to the water resources of the area. Districts are required to consider imposing water conservation practices when issuing consumptive use permits (§§ 62-40.412(2)(c) through (h)).Districts are required to prepare regional water supply plans for areas where reasonably anticipated sources of water are deemed inadequate to meet projected demands through 2020. Four of the five districts determined in 1998 that this condition applied to at least a portion of their jurisdictions. Of 22 state regions, 12 regions containing approximately 85 percent of the state's population were initially selected for the development of regional water supply plans. (OPPAGA 1999) The districts do a water supply assessment every five years. Based on the assessment they determine which regions need a regional water supply plan. The water supply assessment updates have been conducted and the updated regional water supply plans are to be completed in early 2006. (Trimble)

The **Florida Department of Agriculture** and the federal **Natural Resource Conservation Service** work with agricultural interests on conservation best management practices.

Reuse Organizations

The **Department of Environmental Protection** (DEP) coordinates the state's reuse program and administers the domestic wastewater permitting program. Regarding reuse, Florida's Water Reuse Coordinator, employed by the DEP, coordinates statewide reuse activities and chairs the Reuse Coordinating Committee and the Reuse Technical Advisory Committee (see below). The DEP's six regional offices implement the Domestic Wastewater Permitting Program, which includes permitting of reuse activities.

In order to help coordinate the state's reuse program, the **Reuse Coordinating Committee** was formed in 1992. The committee currently includes representatives from the Department of Environmental Protection, the Public Service Commission, the Department of Health, the Department of Agriculture and Consumer Services, the Department of Community Affairs, the Department of Transportation, and the water management districts. The coordinating committee meets regularly to coordinate reuse activities and promote communication among the member organizations. Representatives of permit programs from the six districts of the Department of Environmental Protection also meet regularly with their counterparts from the five water management districts to coordinate issues regarding reuse. In addition, a **Reuse Technical Advisory Committee** provides input into Department of Environmental Protection rulemaking.

The **Public Service Commission** regulates reuse rates, as well as other rates for investor-owned utilities. Florida statutes provide for reuse costs to be recovered from a utility's potable water, wastewater, or reclaimed water customers, or any combination thereof, as the Public Service Commission deems appropriate. The Commission has entered into a Memorandum of Understanding with the Department of Environmental Protection to provide feasibility analyses of the financial impacts of water use projects and will jointly conduct meetings with the Department to inform customers of the need for reuse projects and their potential rate impacts.

The **Department of Health** plays an important role in developing the state's high-level disinfection requirements for protecting public health. Reclaimed water facilities must meet high-level disinfection requirements, producing water that, even though not intended for drinking, meets many primary and secondary drinking water standards.

The **water management districts** also play key roles in the state's Water Reuse Program. Each water management district has a representative on the Reuse Coordinating Committee, and one member of the Reuse Technical Advisory Committee represents the five districts collectively.

Statutory Framework for Water Conservation in Florida

Water Conservation Statutes

The Florida Water Resources Act, Chapter 373, F.S., established the current framework for water resources management in Florida. It established the five water

management districts (§ 373.069) as well as a framework for the Florida water plan and district water management plans (§ 373.036). Section 373.036 requires the Department of Environmental Protection, in cooperation with water management districts, regional water supply authorities, and others, to develop the Florida water plan. It also requires the governing boards of water management districts to develop district water management plans. The Florida water plan outlines programs and activities of the department related to water supply, water quality, flood protection and floodplain management, and natural systems. It includes the district water management plans, the water quality standards of the department, goals and objectives, and guidance (in the form of Chapter 62-40, F.A.C.) for the development and review of programs, rules, and plans relating to water resources.

District water management plans must include, among other elements, an assessment of water supply, including whether reasonably anticipated sources of water and conservation efforts are adequate to meet existing and anticipated future needs and to sustain the water resources and natural systems. In the formulation of the plan, the governing board must consider the prevention of wasteful, uneconomical, impractical, or unreasonable uses of water resources.

Section 373.0361 of the Act requires regional water supply planning for each water supply planning region identified by the district water management plan where sources of water are not adequate for the planning period (20 years) and to sustain water resources and natural systems. Each regional water supply plan is based on a 20-year planning period and must include a quantification of water supply needs for all existing and reasonably projected future uses within the planning horizon. It must also include a list of water source options, including traditional and alternative source options, from which local government, government-owned and privately owned utilities, self-suppliers, and others may choose for water supply development, the total capacity of which will, in conjunction with water conservation and other demand management practices, exceed the needs identified in the quantification of water needs.

In 2004, **House Bill 293** created a new section to the Florida Code, § 373.227, F.S., pertaining to water conservation objectives and comprehensive statewide conservation program requirements. “The overall water conservation goal of the state is to prevent and reduce wasteful, uneconomical, impractical, or unreasonable use of water resources. The Legislature finds that the social, economic, and cultural conditions of the state relating to the use of public water supply vary by service area and that public water supply utilities must have the flexibility to tailor water conservation measures to best suit their individual characteristics. The Legislature encourages the use of efficient, effective, and affordable conservation measures.” To implement these objectives, the Department is required to develop, in cooperation with the water management districts and other stakeholders, a comprehensive statewide conservation program for public water supply. The program should:

- Encourage utilities to implement water conservation programs that are economically efficient, effective, affordable, and appropriate;

- Allow no reduction in, and increase where possible, utility-specific conservation effectiveness over current programs;

- Be goal-based, accountable, measurable, and implemented collaboratively with water suppliers, water users, and water management agencies;

- Include cost and benefit data on individual water conservation practices to assist in tailoring practices to be effective for the unique characteristics of particular service areas;

- Use standardized public water supply conservation definitions and standardized quantitative and qualitative performance measures for an overall system of assessing and benchmarking the effectiveness of conservation programs and practices;

- Create a clearinghouse or inventory of water conservation programs and practices available to public water supply utilities. The clearinghouse or inventory should have technical assistance capabilities to aid in the design, refinement, and implementation of water conservation practices and programs;

- Develop a standardized water conservation planning process for utilities;

- Develop and maintain a Florida-specific water conservation guidance document containing a menu of affordable and effective water conservation practices to assist public water supply utilities in the design and implementation of conservation plans tailored for their individual service areas; and

- As part of an application for a consumptive use permit, a public water supply utility may propose a goal-based water conservation plan that is tailored to its individual circumstances. Progress towards goals must be measurable.

Preference is given in the consideration of permit applications by section 373.621: "The legislature recognizes the significant value of water conservation in the protection and efficient use of water resources. Accordingly, consideration in the administration of 373.223 [conditions for a permit], 373.233 [competing applications], and 373.236 [duration of a permit] shall be given to applicants who implement water conservation practices pursuant to 570.085 (below) or other applicable water conservation practice as determined by the department or a water management district.

Xeriscaping, Landscaping, and Irrigation Statutes

Several sections of the Florida Statutes relate to requirements for Xeriscaping (also referred to as "Florida friendly landscaping"). **Section 166.048, F.S.,** requires the governing body of municipalities to consider enacting ordinances requiring the use of Xeriscpape as a conservation practice, and to enact such ordinances if the finding is that

Xeriscape would be of significant benefit. The governing body must also consider promoting Xeriscape by using these principles in landscaping in, around, and near facilities, parks, and other common areas under its jurisdiction, and to provide public education and incentives for the use of Xeriscape. Section 125.568 establishes the same requirements for county governments.

Section 255.259, F.S., requires the Department of Management Services, in consultation with the Department of Environmental Protection, to adopt rules and guidelines for the required use of Xeriscape on public property associated with publicly owned buildings or facilities constructed after June 30, 1992. A five-year program for phasing in the use of Xeriscape must be developed for facilities constructed before that date

A fourth important statute related to Xeriscaping is found in the Florida Water Resources Act, **section 373.185, F.S**. This section requires water management districts to design and implement an incentive program to encourage all local governments within its jurisdiction to adopt new ordinances or amend existing ordinances to require Xeriscaping. Each district must adopt rules governing the review and approval of local government ordinances intended to qualify the local government for the incentive program. Each district must also assist in this process by providing model Xeriscape code and other technical assistance. In order to qualify for a district's incentive program, a local Xeriscape ordinance must include, at a minimum:

- Landscape design, installation, and maintenance standards that result in water conservation, including the promotion of the use of solid waste compost, efficient irrigation systems, and other water-conserving practices;

- Identification of prohibited invasive exotic plant species;

- Identification of controlled plant species, accompanied by conditions under which such plants may be used;

- A provision specifying the maximum percentage of turf and the maximum percentage of impervious surfaces allowed in a Xeriscaped area and addressing the practical selection and installation of turf;

- Specific standard for land clearing and requirements for the preservation of existing native vegetation;

- A monitoring program for ordinance implementation and compliance. The districts also shall work with local governments to promote, through educational programs and publications, the use of Xeriscape practices, including the use of solid waste compost, in existing residential and commercial development.

Section 373.228, F.S., regulates landscape irrigation design. The water management districts are required to work with 10 specified agencies and organizations to develop

landscape irrigation and Xeriscape design standards for new construction. Local governments must use the standards and guidelines when developing landscape irrigation and Xeriscape ordinances. Every 5 years, the agencies and entities specified in this section shall review the standards and guidelines to determine whether new research findings warrant modifications.

Section 373.62, F.S., requires that as of May, 1991, any person who purchases and installs an automatic lawn sprinkler system must install, maintain, and operate, a rain sensor device or switch that will override the irrigation cycle of the sprinkler system when adequate rainfall has occurred.

Section 570.085, F.S., deals specifically with agricultural water conservation. It requires the Department of Agriculture and Consumer Services to establish an agricultural water conservation program that includes the following:

- A cost-share program for irrigation system retrofit and application of mobile irrigation laboratory evaluations for water conservation and, where applicable, for water quality improvement; and

- The development and implementation of voluntary interim measures or best management practices, adopted by rule, which provide for increased efficiencies in the use and management of water for agricultural production.

Water System Conservation Statutes

The Legislature, in **section 373.619, F.S.,** "urges all public-owned or investor-owned water and sewerage systems to reduce connection fees and regular service charges for customers who utilize water or sewer-saving devices, including but not limited to graywater disposal systems."

Water Reuse Statutes

Florida's key statutory language dealing with reuse is found in **Section 403.064**, F.S. (Chapter 403, Environmental Control, is under Title XXIX, Public Health) which establishes the promotion and encouragement of reuse and water conservation as formal state objectives. The statute encourages local governments to implement reuse programs and encourages the development of incentive-based programs for reuse implementation. Additional provisions include, but are not limited to, the following:

- Within water resource caution areas, applicants for domestic wastewater permits are required to prepare reuse feasibility studies as part of their application process, with certain capacity exceptions;

- Local governments may allow the use of reclaimed water for inside activities, including, but not limited to, toilet flushing, fire protection, and decorative

water features, as well as for outdoor uses, provided the reclaimed water is treated in accordance with Department rules;

- Utilities (except electric utilities) implementing reuse projects are encouraged to meter use of reclaimed water by all end users and to charge for the use of reclaimed water based on the actual volume used when such metering and charges can be shown to encourage water conservation;

- Local governments are allowed to recover the costs of reuse feasibility studies as well as program implementation in a reasonable manner; and

- Consumptive use permits must be consistent with local reuse programs, and the permitting agency issuing consumptive use permits shall consider the local reuse program in issuing permits.

As reuse has become an integral part of water and wastewater management in Florida, state facilities are required, as feasible, to use reclaimed water. Florida Code 403.0645 requires state facilities to use reclaimed water to the greatest extent possible for landscape irrigation, toilet flushing, aesthetic features such as decorative ponds and fountains, cooling water, and other useful purposes allowed by department rules at state facilities, including but not limited to, parks, rest areas, visitor welcome centers, buildings, college campuses, and other facilities.

Chapter 373 of the Florida Code (Water Resources) also deals with reuse of reclaimed water. As in the environmental control statutes, water conservation and reuse of reclaimed water are proclaimed to be in the public interest, and their encouragement and promotion are state objectives (§ 373.250). The same section specifies that a water management district may require the use of reclaimed water in lieu of surface or ground water when the use of reclaimed water is environmentally, economically, and technically feasible and of such quality and reliability to as is necessary to the user. Water management districts shall adopt rules, in consultation with the Department, to implement this section, including but not limited to the following:

- Provisions must be made to permit use of water from other sources in emergency situations if reclaimed water becomes unavailable;

- Water management districts may not adopt any rule which gives preference to users within any class of use who do not use reclaimed water over users within the same class who use reclaimed water.

Several other statutes (§ 403.135, § 403.086(7), § 373.1961, § 367.081, § 373.019 and Chapter 90-262) provide additional guidance in terms of administrative structure for water management including reuse, state objectives regarding reuse, funding priorities, liability issues, discharge of excess reclaimed water, cost recovery of reuse projects, and issues specific to the Indian River Lagoon System.

Water Reuse Rules

Chapter 373.250, F.S., declares that the promotion of water conservation and reuse of reclaimed water are state objectives and considered to be in the public interest. While the statute does not require reuse, it authorizes the water management districts to require the use of reclaimed water in lieu of surface or ground water when the use of reclaimed water is environmentally, economically, and technically feasible, and when the reclaimed water is of quality and reliability as necessary for the user.

Chapter 62-40, F.A.C., entitled "Water Resource Implementation Rule," charges the DEP and the water management districts with promoting and directing the reuse of reclaimed water. Section 62-40.416 directs the water management districts to require reuse of reclaimed water pursuant to the conditions specified in the statute. The rule specifies that in the adoption and implementation of consumptive use permitting rules, the reuse of reclaimed water and the recycling of stormwater or industrial wastewater is required of all users, unless such reuse or recycling is not economically, environmentally, or technically feasible.

Treatment and disinfection requirements for reclaimed water are established in Rules 62-600.530 and 62-600.440, F.A.C. In order to be reused as reclaimed water, domestic wastewater must meet at least basic disinfection, pH, and secondary treatment standards.

Monitoring requirements are contained in Chapter 62-601, F.A.C. Specific procedures are required for ground water monitoring, as well as monitoring at domestic wastewater treatment facilities, as well as at land application sites.

Chapters 62-4 and 62-302, F.A.C. contain the Antidegradation Policy, which requires that any proposed new or expanded surface water discharges must be in the public interest. The public interest test includes evaluating the feasibility of reuse as an alternative to surface water discharge.

Detailed regulations regarding various uses of reclaimed water are contained in Chapter 62-610, including rules for filtration basins, aquifer recharge, industrial uses, irrigation of public access areas and residential properties, and irrigation of edible and non-edible crops. Specifications include allowable uses, responsibility for public safety, setbacks from potable supply sources, signage for ensuring public safety, and many others.

Note: Each water management district has also developed its own series of rules designed to implement programs authorized by statute or state rule.

Water Conservation Initiatives

2001 Florida Water Plan: Implementing Watershed Management

The Florida Water Plan is the Department of Environmental Protection's primary planning tool for Florida's long term water resources management. It identifies

significant water resource management priorities facing the state and sets forth strategies for addressing them. (Water Plan, p. 1-2) The plan includes sixteen priorities in six categories of management issues, one of which is water supply. For each priority issue, goals, objectives, strategies, and action steps are identified. The priority related to conservation and efficiency is to "increase available supplies and maximize overall water use efficiency to meet identified existing and future needs." The plan recognizes the interrelationship of water quantity, quality, storage, and other issues in the action steps it recommends for meeting supply challenges.

Florida Water Conservation Initiative (April, 2002)

In response to growing water demands, water supply concerns, and one of the worst drought s in Florida history, the Florida DEP, in collaboration with the water management districts, water providers, water users, and many stakeholders, led a Statewide Conservation Initiative to find ways to improve efficiency in all categories of water use (DEP, 2002). Rather than addressing short-term emergency water management, the emphasis of the initiative was on achieving permanent water use efficiencies through potential technological, behavioral, educational, regulatory, and economic methods. Interested parties volunteered to participate in one or more of six workgroups: agricultural irrigation, landscape irrigation, indoor water use, water pricing, industrial/commercial/institutional, and reuse of reclaimed water. Each workgroup prepared a report assessing the pros and cons of a variety of water conservation and efficiency ideas in terms of how much water could be saved, cost effectiveness, and ease of implementation.

Joint Statement of Commitment for the Development and Implementation of a Statewide Comprehensive Water Conservation Program for Public Water Supply

In order to implement practices recommended by the Florida Water Conservation Initiative, the DEP, the five water management districts, the Florida Public Service Commission, the Utility Council of the American Water Works Association (Florida Section), the Utility Council of the Florida Water Environment Association, and the Florida Rural Water Association signed a Joint Statement of Commitment (JSOC) to cooperatively develop a program. The Joint Statement has been in effect since February, 2004, and was the basis for Section 8 of House Bill 293, enacted during the 2004 legislative session. The signatories of the Joint Statement agreed that the following steps should be taken, along with specified provisions for accomplishing each:

- Improve the measurement and evaluation of water conservation programs and practices;

- Improve the design and implementation of water conservation programs;

- Ensure regulatory frameworks to adequately support flexibility in the design of water conservation programs; and

- Enhance assistance and information sharing regarding water conservation programs

In December 2004, the signatories of the Joint Statement adopted a *Work Plan to Implement Section 373.227, F.S. (House Bill 293) and the Joint Statement of Commitment for the Development and Implementation of a Statewide Comprehensive Water Conservation Program for Public Water Supply*. The Work Plan provides a detailed blueprint to direct the implementation of the conservation program mandated by section 373.227, F.S., and is the basis for evaluating progress toward implementing its provisions. The work plan contains three main elements: standardized water conservation terms and performance measures; an interactive, web-based water conservation guidance document to aid public water supply utilities in developing goal-based water conservation programs; and a statewide water conservation clearinghouse to collect, analyze, and disseminate information on water conservation programs and practices and their effectiveness. (Trimble)

Mobile Irrigation Laboratories

Mobile Irrigation Laboratories, typically consisting of one or two irrigation professionals, a vehicle, and equipment used for evaluating irrigation systems, provide education and technical assistance to irrigation system operators. MIL teams evaluate existing water use, identify potential conservation opportunities, and provide technical guidance on improving water delivery efficiency. The Southwest Florida Water Management District established the first MILs in Florida in 1986, and there are currently 15 labs providing irrigation services in 36 counties. Six MILs provide services to both agricultural and urban water users. Funding for the MILs is not centralized, but comes from a variety of sources, including the USDA-Natural Resources Conservation Service (NRCS), county governments, water management districts, the Florida Department of Environmental Protection, the Florida Department of Community Affairs, and the National Estuary Program. (Florida Water Policy, July, 2005)

Reuse Initiatives

Refinements to Florida's Water Reuse Program

When wastewater utilities began to implement reuse systems in the late 1980s and 1990s, they were faced with the challenge of creating a market for their reclaimed water. Many customers were skeptical and reluctant to use reclaimed water and, to encourage use, many reclaimed water facilities provided reclaimed water at greatly reduced rates, or even at no cost. As customer bases grew, these low rates encouraged overuse and waste of reclaimed water, which became a burden for utilities. Facilities were designed to accommodate high summertime use, even though total annual use of reclaimed water was significantly lower. During summer months, demand was such that facilities struggled to provide enough water (especially during the drought of 2000-2001), and supplemental supplies from surface water or ground water sources were often required. During winter months, the facilities disposed of unused water.

The need to recognize reclaimed water as a valuable resource became clear, and several forums, including the 2000 and 2001 Reuse Roundtables (open, annual gatherings of environmental and water reuse professionals), focused on how to ensure that reclaimed water is used efficiently and effectively. The 2001 Florida Water Plan includes provisions related to this concept.

The most important work toward promoting greater efficiency of reclaimed water use came with the development of "**Water Reuse for Florida: Strategies for Effective Use of Reclaimed Water**," jointly prepared by the Reuse Coordinating Committee and the Water Conservation Initiative's Water Reuse Workgroup, completed in June, 2003. The purpose of the report is to present general information on water reuse, summarize Florida's Water Reuse Program and the history of reuse in Florida, and identify 16 major strategies for using reclaimed water efficiently and effectively. The strategies generally call for the use of incentives rather than mandates. The strategies for "viewing reclaimed water as a valuable resource" and recommended for use in Florida are as follows:

- Encourage metering and volume-based rate structures;
- Implement viable funding programs;
- Facilitate seasonal reclaimed water storage (including aquifer storage and recovery);
- Encourage the use of reclaimed water in lieu of other water resource in the agricultural irrigation, landscape irrigation, industrial/commercial/institutional, and indoor water use sectors;
- Link reuse to regional water supply planning (including integrated water resource planning);
- Develop integrated water education programs;
- Encourage ground water recharge and indirect potable reuse;
- Discourage effluent disposal;
- Provide water use permitting incentives for utilities that implement reuse programs;
- Encourage reuse in Southeast Florida;
- Encourage the use of supplemental water supplies;
- Encourage efficient irrigation practices;

- Encourage reuse system interconnects;
- Enable redirecting of existing reuse systems to more desirable reuse options;
- Use reclaimed water at government facilities; and
- Ensure continued safety of water reuse.

The report also identifies topics that should be considered for legislative action and rulemaking changes. These include the creation of funding programs; encouragement of metering reclaimed water use and volume-based rates for reclaimed water use; added emphasis on reuse in regional supply planning; consumptive use permitting incentives; mandated use of reclaimed water at state facilities; and longer DEP permits for reuse programs.

Sub-State Water Conservation Efforts

Water Management District Rules

Each water management district has adopted rules and developed programs for water conservation and efficiency. Thus, examples of local conservation efforts in Florida abound. The types of rules and regulations adopted at the water management district level are illustrated by those of the **Southwest Florida Water Management District**. Chapter 40D-22 of the district's rules detail the conservation practices required in the district on a year-round basis. Following is a summary of key water conservation practices required by the district:

> Irrigation of lawns and landscapes is prohibited between the hours of 10 a.m. and 4:00 p.m., and is regulated by an even-odd schedule. Hand-watering of non-lawn areas is allowed, if done with a self-cancelling or automatic shut-off nozzle, at any time. Hand-watering of lawn areas is permitted only on designated days and times, unless spot-treatment is needed to correct a problem. Low-volume irrigation that limits water being applied to the root zone of plants is not restricted for non-lawn areas, but is restricted to designated days and times for lawn areas. Irrigation of new plant material, including sod, may, for a 60-day period to allow for establishment, be watered on any day of the week. On the day of installation, sod and other plant materials may be watered at any time; however, with exceptions, after the day of installation, the designated time restrictions apply.
>
> Many agricultural operations are required to have a Water Use Permit from the water management district, which has specific provisions for maintaining a water budget and implementing conservation practices. Those operations not required to be permitted must either register the use of an alternative irrigation program, such as a published Best Management Practices document, or implement the following water conservation practices:

- All watering must occur before 10 a.m. or after 4:00 p.m., except:

    - Use of micro-irrigation and other low-volume irrigation methods is not restricted;

    - Operation of an irrigation system for plant protection, including prevention of heat stress or frost/freeze damage, is not restricted; and

    - Insecticides and other chemicals can be watered in according to the manufacturer's instructions and as required by law.

Reclaimed water may be used without regard to certain days or times, however, people are asked to voluntarily conserve by not watering between 10 a.m. and 4 p.m. Where reclaimed water is blended with water from other sources, use of blended water is limited to a two-times-per-week watering schedule. Some reclaimed water providers have implemented local water schedules to improve the reliability of their systems.

Additional provisions apply to golf courses and athletic play areas other than golf courses and areas of turf or landscaping, such as cemeteries, exceeding two acres.

Tampa Bay Region

The Tampa Water Department has implemented a variety of water conservation practices, including an increasing block rate structure, public and in-school education programs, plumbing retrofit programs, and other demand-reducing practices. The City of Tampa has also promoted water efficiency by adopting plumbing and landscaping codes, imposing water use restrictions, and charging fines for water use violations. The city also provides free homeowner irrigation evaluations and rain sensors through its "Sensible Sprinkling" program. The combined result of these programs has been a savings of millions of gallons of water per day. Water conserved by the Sensible Sprinkling program is estimated at 25 percent, and Tampa's toilet rebate program alone has saved approximately 245.9 million gallons of water per year. From 1989 to 2001, per capita water use decreased by 26 percent. (USEPA 2002)

Sub-state Programs for Reuse of Reclaimed Water

The South Florida Water Management District has implemented an **Alternative Water Supply Funding Program** that funds up to 50 percent of the total cost of capital improvement projects. Almost half of the funded projects since 1996 have involved reclaimed water (SFWMD 2004).

The **Lower West Coast Regional Irrigation Distribution System** is being developed by a consortium of utilities (in Lee County, Collier County, Cape Coral, Fort Meyers, Bonita Springs, and Naples) to build a regional distribution system which will increase the use of reclaimed water, primarily for irrigation. The system is expected to significantly reduce the draw on the region's freshwater supplies by allowing communities to share reclaimed water (SFWMD, 2004).

The **Comprehensive Everglades Restoration Plan** (CERP) includes several projects involving reclaimed water. The associated Wastewater Reuse Technology Pilot addresses water quality issues involved with discharging reclaimed water into natural areas, including wetlands. (SFWMD, 2004)

The **South Tampa Area Reclaimed Project** (STAR) distributes highly treated wastewater from the Howard F. Curren Advanced Wastewater Treatment Plant to residents and businesses for lawn and landscaping irrigation. Phase One of the project, scheduled for completion in 2005, will serve more than 5,000 residents and is expected to save more than 3.2 million gallons of potable water per day during Tampa's dry season. Phase Two will expand STAR to additional areas of the city. (STAR 2005)

Several areas within the **South Florida Water Management District** with limited water availability (Jupiter, Collier County, Naples, and Cape Coral) have implemented 100 percent reuse. The district is also investigating non-traditional reuse activities, such as a wellfield recharge, salt water intrusion barriers, and surface water augmentation. (DEP 2005)

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Massachusetts

Massachusetts receives an average of 44 inches of precipitation per year, yet in dry years, the amount of water remaining in streams becomes dangerously low for maintaining aquatic ecosystems. According to a recent policy document, during the summer months, the "thin, discontinuous aquifers of eastern and central Massachusetts and the limited aquifers (mainly fractures in bedrock) of western Massachusetts provide the only source of streamflow." (EOEA, June 2005) A recognition of the need to take proactive steps to protect instream flows and ultimately fragile ground water resources has led Massachusetts to adopt progressively more stringent regulations to help reduce water demand and to encourage development of alternative sources, such as that provided by reuse of reclaimed water.

Agency Responsibility for Water Use Management and Conservation

Water management in Massachusetts falls under the purview of several state agencies and organizations, most under the Executive Office of Environmental Affairs, including the Department of Environmental Protection, the Department of Conservation and Recreation (formerly the Department of Environmental Management), and the Massachusetts Water Resources Commission (not an agency itself, but staffed by the Department of Conservation and Recreation). The dispersal of responsibilities poses a variety of challenges for both state agencies and sub-state governments; thus the state is currently promoting a more integrated approach.

The **Executive Office of Environmental Affairs** is the lead agency for the protection of water and other natural resources. The office develops policy, strategy, guidance, tools, and mechanisms to address a variety of environmental issues, with water conservation at the forefront of its water policy agenda.

The **Department of Environmental Protection** is the only regulatory agency in the state. It develops and enforces standards, regulations, policy, and guidance for permitting and other regulatory applications. It also provides technical assistance to municipal water suppliers and other large water users, such as golf courses and cranberry growers. The Executive Office of Environmental Affairs, the parent agency for the Department, also generates water policy and conservation plans.

The **Water Resources Commission** is responsible for regulating interbasin transfers and has generated water conservation standards for that function. The Commission generated the Massachusetts Stressed Basin Report (see below) and is currently developing streamflow targets for habitat protection and new designations for stressed basins.

The **Department of Conservation and Recreation** (created in 2003 from the union of the Department of Environmental Management and the Metropolitan District Commission), is charged with the protection of natural, recreational, and cultural resources of the state. Its Division of Water Supply Protection manages and protects drinking water supply watersheds in the Boston area and provides technical support to

other agencies toward resource protection. The Division of Planning and Engineering provides planning, engineering, design, and construction management services to other departments, including Water Supply Protection.

Statutory Framework for Water Conservation in Massachusetts

The Water Management Act of 1986 (M.G.L.c.21G) provides the foundation for water management and conservation in Massachusetts by authorizing surface water and ground water withdrawal permitting under the Department of Environmental Protection. The statute requires permitting by the Department for any new withdrawal of more than 100,000 gallons per day or nine million gallons during any three-month period. Permit applications must include a detailed water conservation program and implementation timetable. The Department reviews the conservation plan and the timetable and may include these as permit conditions. Each permit holder then must file an annual statement of water withdrawal, which includes metering records, conservation practices implemented in the past 12 months, and water savings that can be attributed to conservation practices implemented.

The Water Management Act also authorizes the Department of Environmental Protection to determine safe yield by a water source. Safe yield has been defined as the volume of water that can be removed from a surface water or ground water source without unreasonable damage to the water resource, but how this is determined has become an arguable point. The statutory guidelines are not detailed, but in the review of permit applications, the consideration of emerging science on the natural variation of streamflow developed by the U.S. Geological Survey (Lamonte). Those guidelines have generally been used in the determination of safe yield since 1986. However, because recent research has offered improved guidance on instream flow needs for water quality and habitat protection, the Department of Environmental Protection has recently adopted more restrictive guidelines. These are reflected in the Massachusetts Water Management Permitting Policy, effective April 2004. (See Department of Environmental Protection Rules, below.)

Additional statutes relate to the use of rate structures to encourage water conservation. The use of descending (decreasing) rates in water pricing is prohibited throughout the state: “No local body shall charge for water or sewer services on a descending unit rate basis.” (M.G.L. § 40-39L) In addition, within the jurisdiction of the Massachusetts Water Resources Authority (described below), all municipalities and water districts must institute a base rate for water that increases at an increasing block rate, with the exception of communities served by the Connecticut Valley Aqueduct (M.G.L. § 165-2B).

Massachusetts Water Policy

In 2004, the Massachusetts Executive Office of Environmental Affairs published the Massachusetts Water Policy, developed by a Water Policy Task Force. The report cuts across all aspects of water policy and builds upon prior policy, emphasizing integration between the state government and regional and municipal organizations. Several aspects

of the report deal directly or indirectly with water conservation, reflected in the following recommendations:

- Develop a "stress framework" to set performance standards within stressed river basins, based on streamflow and biological and chemical integrity. The previous designation of a "stressed basin" is replaced by a tiered stress level framework with a graduated menu of actions related to performance standards, including water efficiency, seasonal peak pricing, water reuse and on-site wastewater recharge, leak detection, metering, and others.

- Develop a policy on preferred methods of meeting water supply demands that establishes conservation as the first source, followed by recharge and reuse of water.

- Develop clear guidance and planning materials to help communities meet existing and future water uses by developing watershed solutions based on water budgets. This includes providing guidance on specific water management tools, such as water banking and use of reclaimed water.

- Actively promote reclaimed water use. Its use is encouraged for irrigation of golf courses, recreational areas, state maintained properties, and large-scale development.

Department of Environmental Protection Rules

Permitting for water withdrawals is the purview of the Department of Environmental Protection. Permitted withdrawals under the Water Management Act are about 15 percent of the total regulated volume of water withdrawn in the state in an average year. Approximately 85 percent of authorized withdrawals come under the Water Management registration program. Permitted volumes are above, on top of, or in addition to registered volumes. (Lamonte)

With the adoption of the Water Management Permitting Policy in April 2004, the number of permits containing performance standards and demand management controls has increased relative to requirements in previous years. According to the 2004 policy, the Department of Environmental Protection will condition permits relative to basin stress, so that aquatic habitat is protected and a stable water budget is maintained in all basins, especially those most highly stressed. Basin stress is classified in the Stressed Basin Report, published by the Water Resources Commission.

Since the adoption of the 2004 policy, the following standards and conditions are included in all new permits, as well as modification and renewal of existing permits:

- Cap on per capita per day residential water use (no more than 65 gallons per capita for high and medium stress basins, and no more than 80 gallons per capita for low stress and unassessed basins);

- Limits on unaccounted-for water (no more than 10 percent for high and medium stress basins, and no more than 15 percent for low stress and unassessed basins);

- Summer limits on withdrawals (limit varies based on prior use);

- Streamflow thresholds that trigger mandatory limits on nonessential outdoor water use, including but not limited to lawn and landscape irrigation;

- Standard and consistent reporting requirements; and

- Streamflow monitoring.

Department of Environmental Protection Guidelines on Reclaimed Water

The Department of Environmental Protection adopted the Interim Guidelines (Revised) on Reclaimed Water in January 2000, and they continue to be in effect. Following is a summary of the reuse and regulatory framework outlined in the Guidelines. Additional requirements apply to the use of reclaimed water for irrigation of golf courses and for landscaping use at nurseries.

- Ground Water Discharge Permits (314 CMR 5.00): Reuse projects that involve the use of reclaimed water in the forms of drip or spray irrigation, injection into the subsurface, or spreading on the land surface are required to obtain a Ground water Discharge Permit from the Department of Environmental Protection.

- Treatment Plant Reliability: Wastewater treatment plants permitted to discharge 10,000 gallons per day or more must meet specific reliability standards which are dependent on the sensitivity of their location and must get a Ground water Discharge Permit from the Department.

- National Pollutant Discharge Elimination System (NPDES) Permits: Reused water that is discharged into an unlined surface water body may be required to obtain an NPDES permit from USEPA, Region I, and a water quality certification permit from the Department.

- Massachusetts Water Management Act (310 CMR 36.00): The Water Management Act (WMA) program regulates water withdrawals of 100,000 gallons per day or more. Reclaimed water users who must supplement with pumped ground water and/or surface water exceeding the Water Management Act threshold require a WMA permit.

- Massachusetts Environmental Policy Act (M.G.L.c.30 s.61-62H – 301 CMR 11.00): Some reclamation projects may surpass threshold values that trigger the

requirements to complete either an Environmental Notification Form or a more detailed Environmental Impact Report.

- State/Local Permits: Some reclaimed water projects may require the oversight of local regulatory authorities. For example, projects that require work in or proximal to wetlands or rivers will need to communicate their intentions to the Conservation Commission.

- Public Awareness: To promote consumer acceptance of reclaimed water, the Department recommends that purveyors and end users continually inform the public, especially potential users, of project status as regulatory and infrastructure decisions are being formulated. Public awareness requirements:

    - Publish and have available at their facility brochures or fact sheets explaining the process used to treat and deliver reclaimed water to the facility, the benefits to the community, and the safeguards employed to make the use of reclaimed water safe for users and abutters.

    - All reclaimed water plumbing and out-of-sight fixtures must be color coded purple.

    - Signs must be posted and portrayed symbolically where public access to reclaimed water is possible, clearly communicating that it is not for drinking. Signs should be in English and any additional locally employed language.

Water Resources Commission: Conservation Standards and Recommendations

Components of a Minimum Water Conservation Plan was adopted by the Water Resources Commission in 1987. Its purpose was to help communities develop local water conservation plans and establish minimum standards based on the needs of individual communities. Since its adoption, the document has been used in the review of a variety of applications, including those required by the Interbasin Transfer Act, the Water Management Act, and others. The Water Resources Commission and the Executive Office of Environmental Affairs are currently reviewing water conservation standards. (Lamonte)

Water Conservation Standards for The Commonwealth of Massachusetts, prepared for the Water Resources Commission, was adopted in October 1992. This document provides standards and recommendations to be used in all programs affecting the planning and management of the state's water resources and for use in all construction, rehabilitation, and facility development activities statewide. The Massachusetts Water Policy (2004) recommends the revision of these standards to include new information that has become available since the early 1990s. Following are the standards currently in place:

- Public Education: Each community should develop and implement an education plan which should include most, if not all items on the following basic list.

    - The largest users should be targeted early to realize the greatest potential savings and to demonstrate the benefits of a conservation program.

    - Public education should reach to the schools; develop/use media that will appeal to children, including getting them involved with environmental/water resources projects and field trips.

    - Bill stuffers and/or bills should have a work sheet on the reverse to enable customers to track water use and conservation efforts and figure the dollar savings.

    - Public space advertising/media stories on successes (and failures).

    - Conservation information centers, perhaps run jointly with electric or gas company.

    - Speakers for community organizations.

    - Public service announcements; radio/T.V./audio-visual presentations on supply sources and current status.

    - Joint advertising with hardware stores to promote conservation devices.

    - Use of civic and professional organization resources.

    - Special events such as conservation fairs.

    - Multilingual materials should be available as needed.

    - Contests and recognition for innovation could be incorporated into the public education program.

    - Information on Xeriscaping, gardening, and lawn care practices.

- Leak detection and repair:

    - A full leak detection survey of the distribution system should be completed every two years. Leak detection and repair should be recognized as expenses of the water supply system and included in a full-cost pricing structure.

- Metering:

    - Each public water supplier should develop a program to implement 100 percent metering of all public sector and private users with meters of proper size and accuracy to ensure full registering of water flow.

    - The metering program should include regular meter maintenance, including testing, calibration, repair, replacement, and checks for tampering to identify and correct illegal connections.

    - The metering program should include regular meter reading of all public sector users and regular accounting of their use.

    - Meter reading and billing for domestic accounts should be done quarterly, with the understanding that customers should be billed on actual meter readings.

    - Master meters (which register the flows in the municipal system) should be calibrated annually.

- Pricing:

    - The water pricing structure should include the full cost of operating the water supply system.

    - Water supply system operations should be fully funded by water supply system revenues.

    - Each water supplier should regularly evaluate existing rate structures, including any peak demand and seasonal pricing components. In addition, the water supplier should consider all possible pricing options, such as increasing block rates.

    - Water and sewer rates, were applicable, should be billed so as to inform customers of their actual use and the cost of each.

- Residential water use:

    - Water suppliers, in cooperation with manufacturers and professional organizations, should make available to residential users at least the following water saving devices: low-flow shower heads; faucet aerators, toilet displacement devices and/or low-flow toilets, toilet leak detection kits; and educational literature about installation and water conservation savings (in gallons and dollars), including outdoor watering and Xeriscaping.

- The state plumbing code should be strictly and consistently enforced at the local level.

➢ Public sector water use:

- Government facilities, including school departments and hospitals should account their full use of water.

- Public buildings should be built or retrofitted with equipment that reduces water use.

- Water used by contractors using fire hydrants for pipe flushing and construction should be metered and they should be charged, including service fees.

- Irrigation of municipal property should be sensitive to soil moisture or should be subject to operational procedures that avoid watering during the hottest part of the day or during precipitation events.

- Strictly apply plumbing codes and incorporate other conservation practices in new and renovated buildings.

➢ Industrial, commercial, and institutional water use:

- All industrial, commercial, and institutional water users should develop and implement a written water policy, addressing among other items: demand management, leak detection and repair, a program of preventative maintenance, and a program of employee education.

- All industrial and commercial water users should carry out a water audit to determine the location and amount of water used for heating, cooling, processing, sanitary use, and outdoor use. The audit should serve to identify functions, activities, and locations where water savings could be readily achieved and the extent to which modifications could reduce or eliminate unnecessary water use.

- In new and renovated buildings, comply with plumbing codes and use the best available technologies for water conservation.

Other Water Conservation Initiatives

In May 2002, the Massachusetts Water Resources Commission released the Guide to *Lawn and Landscape Water Conservation: A Guide for Communities, Property Owners, Managers, and Massachusetts State Agencies*. The guide gives detailed information and

recommendations on conservation practices and development of municipal by-laws and water conservation ordinances, including a model water use by-law/ordinance.

Sub-State Water Conservation Efforts

The Massachusetts Water Resources Authority, a public water supplier serving 43 communities, including Boston, implemented an aggressive water conservation program in 1986 to address a long-standing problem of withdrawals that exceeded safe yield. Since 1989, withdrawals have been below the safe yield, due to the combined effect of the following conservation practices:

- Vigorous leak detection and repair efforts on Authority and community pipes;
- Retrofitting 370,000 homes with low-flow plumbing devices;
- A Water Management Program for area businesses, municipal buildings, and non-profit organizations;
- Extensive public information and school education programs;
- A change in the state plumbing code requiring new toilets to be 1.6 gallons per flush;
- Meter improvements that helped track and analyze community water use;
- New water-efficient technology that created reductions in residential use; and
- Water pipeline replacement and rehabilitation projects throughout the Authority and community systems.

Success of Water Conservation Efforts in Massachusetts

Implementation of a wide variety of water conservation practices by the Massachusetts Water Resources Authority has resulted in a significant decrease in per capita water use as well as overall demand. From 1969 to 1988, the Authority's customers consistently withdrew more than was considered "safe yield." With the launch of aggressive water conservation programs in 1986, water use was brought within what was considered safe yield and has remained there ever since (MWRA, May 2005). Conservation efforts within this service region resulted in average daily demand of 336 million gallons per day (mgd) in 1987 to 256 mgd in 1997, which allowed for a reduction in the size of the Authority's planned treatment plant, as well as a 20-year deferral of the need for an additional supply source (USEPA 2002).

According to a 2004 report, Massachusetts' permitted withdrawals under the Water Management Act were approximately 15 percent of the total regulated volume of water withdrawn in the state in an average year. With the adoption of the new water permitting

policy in 2004, it is expected that the number of permits containing performance standards and demand management controls to increase (Massachusetts DEP 2004).

The state's success with water conservation has not been without challenge, however. In 2003, when the Department issued water withdrawal permits with a suite of more restrictive conservation practices attached, conservation practices were contested. The first set of such permits was issued in the Ipswich Basin, the most stressed basin in the state. Towns and cities within the basin have contested the permits for being too restrictive in terms of conservation practices, while the Ipswich Watershed Association has contested the permits because they are not restrictive enough. The adoption of the Water Management Permitting Policy in 2004 was motivated and guided in part by these lawsuits. (Lamonte)

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North Carolina

North Carolina's water management provides a valuable collection of experiences for Georgia to draw from in evaluating potential water conservation options. Like Georgia, North Carolina typically receives adequate precipitation in most years to maintain ample water supplies but experiences droughts such that careful water management planning is needed to meet demands. Also like Georgia, this state is experiencing rapid population growth that does not necessarily correspond with locations of abundant water supplies. Demand for water resources is especially keen in the coastal plain and inland population centers.

According to a 1998 report by the North Carolina Rural Economic Development Center, more than half of the state's population relies on ground water (from both public and private sources) as their only source of drinking water. Of the ground water treatment plants surveyed in the study, only 28 percent had any excess capacity, compared with 87 percent of surface water systems with excess capacity.

In addition to the challenge of developing/preserving adequate supplies to meet growing population demands, an immediate impetus for water conservation in North Carolina is protection of ground water resources that in recent years have been subject to overdraft. Problems of land subsidence and salt water encroachment in coastal counties have necessitated a proactive approach to water use management and water conservation.

Agency Responsibility for Water Use Management and Conservation

The **North Carolina Department of Environment and Natural Resources** (NCDENR) implements water use and protection regulations. Within the Department, the Division of Water Resources collects and reviews local water supply plans and water withdrawal registrations (from which data is used to compile basin plans and the State Water Supply Plan), and administers the Central Coastal Plain Capacity Use Area (see below), and participates in a variety of programs for resource and watershed protection.

The **North Carolina Environmental Management Commission** (NCEMC) is a 19-member commission appointed by the governor, the Senate Pro Tempre, and the Speaker of the House. The commission oversees and adopts rules for several divisions of the Department Environment and Natural Resources. The Commission also designates capacity use areas and issues permits.

Statutory Framework for Water Conservation in North Carolina

Several important laws have been passed in North Carolina for the purpose of avoiding depletion of water supplies or creating fair allocation among water users, including the following:

- The **Water Use Act of 1967** (NCGS §§ 143-215.11 through 143.215.22(I)) is the most important statute in terms of water conservation. It allows the Environmental

Management Commission to create Capacity Use Area in parts of the state where water demand threatens to cause conflict between users or to deplete resources. Within Capacity Use Areas, water use permits are required for withdrawals exceeding 100,000 gallons per day. (See Division of Water Resources Rules, below.)

- The **North Carolina Environmental Policy Act of 1971** declared a state policy which "will encourage wise, productive, and beneficial use of the natural resources of the state without damage to the environment." It requires state agencies to review and report on the potential environmental consequences of activities that involve state agencies, public funs, or private use of public lands. Water-related activities regulated under this Act are certain improvements to water treatment plants, ground water withdrawals, and dam construction.

- In July, 1989, the North Carolina General Assembly ratified **House Bill 157** in response to long-term drought and aquifer depletion. This bill added sections (l) and (m) to the General Statute §143-355, which mandates local and state water supply planning.

  Section (l) requires local governments to prepare Local Water Supply Plans, which are to include evaluations of present and future water demands and supplies, an estimate of technical assistance needed to address projected water needs, and accounting of water use by sector. Each local government is to prepare a local water supply plan and update that plan at least every five years for review by the Division of Water Resources. When evaluating the plans, the Division encourages systems whose demands are approaching 80 percent of their available supplies to develop demand management plans. More than a fifth of the water supply systems projected reaching 80 percent of their supply capacity by 2020.

  Section (m) of the statute requires the development of a State Water Supply Plan by the Division of Water Resources, based on information contained in the Local Water Supply Plans and other appropriate resources. The state plan contains a detailed discussion of current and upcoming water supply issues and, like the local plans, it is updated every five years.

  Based on surveys of local governments and discussions with local officials, the Division of Water Resources developed a handbook, entitled "Guidelines for Minimum Requirements of a Local Water Supply Plan," to assist local governments with data collection and plan preparation. A pilot study was conducted in Moore County in 1992 to review local plan development, with the findings used refine the guidelines and develop additional technical material. The revised guidelines were reviewed by a number of state and regional organizations and, and in early 1993, guidelines, forms, and instructions were distributed to local governments to assist with the preparation of plans. Drafts

for the 1997 plans were to be submitted no later than January 1, 1999, and as of December 2000, 537 of the 553 water systems expected to prepare plans had either adopted a plan or had submitted a draft plan for approval. In addition, numerous private water systems voluntarily completed water supply plans.

- In 1991, the General Assembly amended the Water Use Act to require that all surface water withdrawals or transfers exceeding one million gallons per day must register those withdrawals with the Division of Water Resources (NCGS §143-215.22H). In 1993, this was expanded to include withdrawals or transfers of ground water, and it exempted local government water systems with local water supply plans. In 1998, the threshold for registration was lowered to 100,000 gallons per day, except for agricultural use, which remained at one million gallons per day. All registrations must be updated every five years.

- In October 2002, The North Carolina General Assembly ratified **House Bill 1215** to address both short-term drought emergency response and long-term water conservation, efficiency, and reuse. The bill called for a variety of initiatives, including the following:

  - Required the Department to develop a state water supply plan, including the projections and information in the local plans; a summary of water conservation and reuse programs described in local plans; a summary of the technical assistance needs indicated by local plans; and a discussion of the compatibility of local plans, with potential conflicts and ways of increasing coordination identified.

  - Established a goal for state agencies to reduce water consumption by at least 10 percent.

  - Required the Department to evaluate conservation practices being implemented by the state and identify incentive programs and other voluntary programs to help foster water conservation and reuse. A report detailing its findings and recommendations was to be submitted by February, 2004.

  - Required the Environmental Management Commission to develop and implement rules governing water conservation and reuse during drought and emergency situations. These rules are to establish minimum standards and practices for water conservation and reuse for specific classes of water users.

  A related bill, **House Bill 1062** (S.L. § 2003-387) required each local government that provides public water service to prepare a local water supply plan and submit it to the Department of Environment and Natural Resources.

Related Statutes

- The **Dam Safety Law of 1967** (G.S. § 143-215.25(4)) establishes requirements for minimum streamflows below dams and provides a mechanism for maintaining adequate instream flows as water withdrawals increase.

- The **Coastal Area Management Act of 1974** (G.S. § 113A-100) establishes a cooperative program between state and local governments and details coastal management policies and guidelines for local leaders in coastal counties. Land planning is a central focus of the Act; however, the land use planning guidelines require that all Local Water Supply Plans that fall within the 20 coastal counties must be included as an appendix to the land use plan and may be referred to in the plan. This requirement promotes the consideration of future water needs in land use planning.

- The **Clean Water Management Trust Fund** (G.S. §113-145.1 et seq) was established in 1994 to prevent water quality degradation through grants offered to local and regional governments. The state allocates a minimum of $30 million each year. Large grants may be used to purchase riparian property that affects drinking water quality, and small grants may be used to improve wastewater and stormwater systems and water treatment and delivery needs. Although these grants are not used in North Carolina for water conservation programs, this type of system may have potential utility for this purpose, especially for plumbing retrofit and reclaimed water use projects.

Division of Water Resources Rules

Agency rules for water conservation in North Carolina focus primarily on the Central Coastal Plain Capacity Use Area (CCPCUA), established in response to ground water overdrafts that were resulting in salt water encroachment and land subsidence. The CCPCUA rules became effective Aug. 1, 2002.

Registration and annual reporting of water withdrawals is required of water users withdrawing more than 10,000 gallons per day from ground water or surface water sources. Registrants are required to withdraw water in a manner that does not cause salt water encroachment or other damage. Registrations must be updated every five years. (DWR Rule .0505)

Permits are required for ground water withdrawals of more than 100,000 gallons per day (permitting is not required for surface water withdrawals). Conservation practices are required of all permit holders. Public water systems are required to develop conservation practices that include a water conservation ordinance for outdoor irrigation; a water loss reduction program; a conservation rate structure; a plumbing retrofit program; and a public education program. Commercial water users must implement an audit of water use by type of activity (processing, cooling, etc.), including existing and potential conservation and reuse practices for each type. They must also develop an implement-

tation schedule for feasible practices identified. Users of water for irrigating agricultural crops or forestry stock must provide information on acreage irrigated, types of crops that may be irrigated, method of irrigation, and a statement that the applicant uses conservation practice standards for irrigation as defined by the [U.S. Department of Agriculture] Natural Resources Conservation Service. (DWR Rule .0502(d)(5))

Water reductions are required for ground water use from the Cretaceous aquifer within the Capacity Use Area over a 16-year period, with specific reductions required during each of three phases (six years, five years, and five years, respectively, ending in 2018). The reductions required are based on zones of the aquifer designated by level of withdrawal stress.

Reuse Regulations

Reclaimed water may be used in North Carolina for a variety of purposes, including agricultural and residential irrigation, industrial purposes (such as processing or cooling water), dust control, fire fighting, aesthetic purposes such as fountains, toilet flushing, vehicle washing, and other purposes. It may not be used for direct potable supply, to fill swimming pools or hot tubs, or for irrigation of direct food chain crops. If it is used to irrigate areas intended to be accessible to the public, specific guidelines are required to assure public safety. Additional requirements relate to detention ponds, buffer requirements, rates of application for certain uses, and transport and storage. (15-A NCAC .0200(K)) The primary use for reclaimed water in North Carolina is irrigation of golf courses, with a limited amount used for residential irrigation and industrial uses (Thornburg).

Other Water Conservation Initiatives

In 1994, the North Carolina Rural Economic Development Center and the North Carolina Rural Development Council launched a joint project called the ***North Carolina Water and Sewer Initiative.*** The initiative included an in-depth assessment of 659 water and sewer systems in 75 predominantly rural counties. The study culminated in the nation's first comprehensive, standardized compilation of information on a state's public water and sewer systems. The report, published in 1998, identified numerous needs and concerns for providing adequate water services. Although the report did not specifically address water conservation, it established a valuable information base with which to help guide later water management efforts.

In the fall of 1998, Governor James Hunt issued a challenge to the state government to set an example of environmental stewardship, which has become known as ***North Carolina Project Green.*** The program has been quite successful and has garnered the participation of approximately 30 agencies. Initially, the program emphasized energy conservation, reduction of solid waste, and other environmental impacts, but since the inception of programs in 2001 and 2002, it has become focused on water conservation as well.

North Carolina's most significant effort to manage water demand in times of shortage came in 2001 with the *Water Shortage Response Handbook*, developed by the North Carolina Department of Environment and Natural Resources. The Handbook describes a variety of conservation practices for indoor and outdoor residential water use, industrial use, and health care facility use. These practices were suggested for voluntary implementation during the first of three phases of water shortage response, the Voluntary Conservation Phase, but were not expected to be implemented during times of abundant water supplies. In the Mandatory Restriction Phase and the Emergency Phase, more stringent goals and requirements were mandated. The Handbook notes that the drought response program should be part of an overall water conservation plan that includes water loss reduction, water efficiency, and public education and outreach.

In August, 2002, Governor Michael Easley issued **Executive Order No. 26**, (Water System Protection) calling for all state government agencies to discontinue "non-essential" water use until further notice and for all such agencies to develop and begin implementing long-term, financially feasible conservation practices. The order also requested that all other state-sponsored institutions comply with those directives. Because no further notice regarding non-essential water consumption was given, state government agencies were not allowed to use water for non-essential uses until they developed and began implementing water conservation practices. To help agencies and institutions develop conservation plans, the Division of Pollution Prevention and Environmental Assistance created an informational web page and sample plan, and offered individual guidance. (PPEA, March 2005)

The same Executive Order established the **Water System Protection Team**, chaired by the Secretaries of Crime Control and Public Safety, and Environment and Natural Resources and including representatives from state and regional government and non-government entities. Its duties include providing guidelines to assist agencies and institutions comply with the order, to assist drought-stricken communities in enhancing conservation efforts, and providing technical assistance and other support.

North Carolina experienced an extreme drought in 2002, leading the state's water managers to bolster efforts to ensure adequate future water supplies. During the drought, the Department of Environment and Natural Resources and the Drought Monitoring Council developed a **three-tier drought classification system**, ranking communities according to their drought vulnerability. Many communities took steps to assure water availability during the drought and reduce vulnerability to future droughts.

North Carolina Water Supply Plan

The most recent State Water Supply Plan, released in January, 2001, includes a section on water conservation that is broken into four components: water shortage response, water loss reduction, water use efficiency, and public education and outreach. General guidance is provided for sub-state governments to implement conservation elements such as the development of a conservation ordinance that triggers mandatory water use reduction in times of water shortage; reduction of unaccounted-for water; establishment

of rate structures; promotion of low-flow plumbing fixtures; outdoor water use; and information resources for public education. In addition, the Plan includes a brief summary of water reuse standards and guidance. Current regulations in North Carolina allow reclaimed water to be used for irrigation, cooling water, process water firefighting, street and vehicle washing, and dust control (Administrative Code 15A2H.0219). Reclaimed water may not be used for potable water supply, irrigation of direct food chain crops, or for filling pools.

Sub-State Water Conservation Efforts

The Town of Cary is frequently cited as an example of effective local water conservation. Between 1990 and 2000, Cary's population grew from 43,858 to 96,217, placing significant stress on the town's water resources. The town responded by developing a water conservation program designed to reduce per-capita water use by 20 percent by 2020. Conservation practices implemented include an extensive public information and education program; conservation education for elementary school students; workshops on water efficient landscaping and irrigation techniques; and a "Block Leader" program, in which volunteer leaders attend a training session and optional workshops and distribute informational materials to their neighbors.

Success of Water Conservation Efforts in North Carolina

House Bill 1215 required the Department of the Environment and Natural Resources to prepare a report on water conservation and water use efficiency by February 2004. The report summarizes current practices in the categories of residential water use, water supply systems, business and industrial water use, state government, and agricultural water use. (This report has been updated and will be available in the near future. (Horkavy)) The following are examples of practices that are currently being implemented in the state (DENR 2004):

Residential Water Use: Voluntary residential practices include home water audits, replacing inefficient plumbing fixtures, outdoor irrigation efficiency, and Xeriscaping. Local programs, particularly in the Town of Cary, have achieved significant water savings.

Water Supply Systems: Thirty-one percent of the state's water supply systems have established leak detection programs, and another 26 percent of the systems are in the process of developing such programs. More than eight percent of the water systems use reclaimed water, and the Town of Cary provides non-potable water through a parallel distribution system, to 400 residential and commercial customers. Thirty-four percent of the water systems submitting a 2002 Local Water Supply Plan have a public education program for water conservation. The Town of Ashville has implemented a successful retrofit program which has distributed more than 34,000 kits and produced water savings of seven percent.

Business and Industrial Water Use: Water conservation certification programs exempted businesses from water use surcharges when water use restrictions were imposed in 2002. An estimated 90 million gallons of water are saved each year by certified facilities.

State Government Water Use: The Utility Saving Initiative, led by the State Energy Office, is assisting state agencies and universities to reduce utility costs, including water. Low interest loans are offered to wastewater and water systems based on funding priority points based on different rating variables. Additional priority points are awarded for the implementation of conservation practices.

Agricultural Water Use: Technical assistance for increasing water use efficiency is offered through a variety of organizations, including the Natural Resource Conservation Service, the Soil and Water Conservation Districts, the Agricultural Extension Service, the North Carolina Agricultural Cost Share Program, and the Division of Pollution Prevention and Environmental Assistance. By simply tracking water use and making adjustments to reduce waste, one livestock operation reduced water use by 38 percent.

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Texas

The 2002 Texas State Water Plan, which reflects cumulative effects of 16 regional water plans, recognizes water conservation for its potential to extend existing supplies, reduce consumer costs, and meet wildlife, environmental, and other natural-resource needs. The plan anticipates a significant water supply shortfall in the coming decades, and includes a number of water conservation strategies as a vital part element in addressing the shortfall. Water conservation, including water reuse, may provide economical alternatives to more expensive water-supply solutions, such as reservoirs and well fields.

Agency Responsibility for Water Use Management

The **Texas Water Development Board** is the state agency primarily responsible for water planning and administering water financing for the state (§§6.011 – 6.012) The Board has general jurisdiction over the development of the statewide water plan and the administration of the state's water assistance and finance programs. (The Board assumes previous powers and duties of the Texas Department of Water Resources.) The Board consists of six members appointed by the governor with the advice and consent of the senate, such that each member is from the general public and each from a different section of the state and has no prohibited conflict of interest.

The **Texas Commission on Environmental Quality** (formerly the **Texas Natural Resource Conservation Commission)** is the state's primary environmental agency. Relative to water conservation, its Water Supply Division reviews applications for surface water use, evaluates water conservation plans submitted by several categories of water users, and administers the Water-Saving Plumbing Fixtures Program.

The **Texas Water Advisory Council** was created to provide the governor, lieutenant governor, speaker of the House of Representatives, and the legislature with the resource of a select council with expertise on state water issues.

The **Multi-state Water Resources Planning Commission** is an agency of the state composed of seven members appointed by the governor with the advice and consent of the senate. Each member is from a different section of the state; three members must be from the general public and the remaining four from specified backgrounds (higher education, private business, agriculture, and an energy-related field). The duties of the commission are to interact with other states and with Mexico; create reports with recommendations regarding potential water source areas; designate water deficient areas; negotiate interstate compacts; and study the potential utilization of floodwater.

The **Texas Water Resources Finance Authority** was created (§ 20.001) to encourage and assist in the conservation and development of water resources of the state by increasing the availability of financing by purchasing political subdivision bonds.

Statutory Framework for Water Conservation in Texas

In the early 1900s, water conservation in Texas, as elsewhere, was understood to mean development of water resources using dams, reservoirs, and other water-controlling mechanisms. In 1985, the Texas Legislature expanded the definition of conservation in the Water Code to include reduction of water consumption, more efficient use of water, and increased recycling and reuse of water. The legislation also required retail water suppliers that received state funding and all recipients of new water rights to implement a water conservation plan and/or adopt a drought contingency plan. (TWDB 2002)

In 1991, the Texas Legislature passed the State Water Savings Performance Standards for Plumbing Fixtures Act, which established low-flow performance standards for plumbing fixtures including shower heads, faucet aerators, toilets, and urinals. In 1992, the Federal Energy Policy Act established national standards for plumbing fixture efficiency.

Senate Bill 1, 1997, required water-rights holders (municipal and industrial rights of 1,000 acre-feet (approximately 326 million gallons) or more per year and irrigation rights of 10,000 acre-feet (approximately 3.26 billion gallons) or more per year) to develop and implement water conservation and drought contingency plans. SB 1 also allowed local authorities to grant property tax exemptions for water conservation practices, and allowed the Texas Water Development Board to use principle from the Agricultural Trust Fund to provide financial incentives and/or low-cost loans for the installation of agricultural water conserving devices. (TWDB 2004)

The 78th Texas Legislature (2003) passed several bills related to water conservation:

HB 643 (T.W.C. § 202.007) prohibits the creation or enforcement of certain restrictive covenants that undermine water conservation.

HB 1152 (T.W.C. § 67.011) amended the Texas Water Code to provide certain non-profit water supply corporations the statutory authority to establish reasonable water conservation practices and prohibit excessive and wasteful uses of potable water, and to enforce such practices by assessing reasonable penalties.

HB 2660 (T.W.C. § 11.1271) requires the Texas Commission on Environmental Quality and the Texas Water Development Board to jointly develop model water conservation programs for different types of water suppliers that suggest best management practices for achieving the highest practicable levels of water conservation and efficiency achievable for each specific type of water supplier. Beginning May 1, 2005, all water conservation plans required to be submitted to the Commission with an application for a new or amended water rights permit or to the Board with an application for financial assistance must include specific, quantified, 5- and 10-year targets for water savings. Targets are established by the entity preparing the plan and must include goals for water-loss programs and goals for use in gallons per capita per day.

HB 2661 (T.W.C. § 26.0311) requires the Texas Commission on Environmental Quality, by rule, to adopt and implement minimum standards for certain uses of graywater. The legislation allows graywater to be used for certain agricultural, domestic, industrial, and commercial uses, with certain design criteria, provided that the use of graywater is not a nuisance and does not damage the surface or ground water of the state. Under specific requirements, the domestic use of up to 400 gallons of graywater per day does not require a permit.

HB 2663 (T.W.C. § 11.1272) requires the Texas Commission on Environmental Quality to establish quantifiable goals for drought contingency plans. Beginning May1, 2005, drought contingency plans must include specific, quantified targets for water-use reductions to be achieved during periods of water shortages and drought. These goals are to be used in the development of drought contingency plans and are not enforceable requirements. The bill also calls for the Board and the Commission to jointly develop model drought contingency programs for different types of water suppliers.

HB 3338 (T.W.C. § 16.0121) requires retail public water suppliers to perform a water audit every five years and submit the audit to the Texas Water Development Board. The audits must include a computation of the utility's most recent annual system water loss. The Planning Groups are required to use the information to identify appropriate water planning strategies in the development of Regional Water Plans. The bill also requires water audits to be completed and on file before the Board may provide financial assistance to political subdivisions for water supply projects.

SB 1053 (T.W.C. § 15.602) consolidates certain existing financial assistance programs for agricultural conservation and authorized the Board to provide financial assistance to demonstration projects, technology transfers, and educational programs.

SB 1094 created the Water Conservation Implementation Task Force to review, evaluate, and recommend optimal levels of water use efficiency and conservation for Texas. The Task Force was also directed to develop a best-management practices guide for use by Planning Groups and political subdivisions responsible for water delivery.

Additional Water Conservation Statutes

- The Commission may, by rule, require the owner of any works for the diversion, taking, storage, or distribution of water to construct and maintain suitable measuring devices at points that will enable the watermaster to determine quantities of water diverted, stored, released, taken, or distributed in order to satisfy the rights of the respective users. (T.W.C. § 11.331)

- An apartment house owner, manufactured home rental community owner, multiple use facility owner, or condominium manager may provide for submetering of each dwelling unit or rental unit for the measurement of the quantity of water used by the occupants of that unit. With certain exceptions,

submetering or individual metering of such units is required for new units on which construction began after January 1, 2003. (T.W.C. § 13.502)

- The Commission shall encourage submetering of individual rental or dwelling units by master meter operators or building owners to enhance the conservation of water resources. The Commission shall adopt rules and standards under which an owner of such units, if not individually metered, may install submetering equipment to fairly allocate the cost of water consumption in each individual unit. (T.W.C. § 13.503)

- The executive administrator [of the Commission] shall conduct studies, surveys, and investigations about a variety of water-related matters, including suitable, cost-effective supply alternatives on a regional basis, including voluntary means of encouraging aggressive water conservation. (T.W.C. § 16.012)

- The Board and the State Soil and Water Conservation Board shall jointly conduct a study of the ways to improves or expand water conservation efforts and report to the legislature. The report must include assessments of existing agricultural and municipal conservation issues and efforts, discussion of future conservation needs, analysis of water conservation approaches and funding, and assessment of statutory authority and possible statutory changes needed to more effectively fund and promote conservation projects. The report was completed in September 2003. (T.W.C. § 16.022)

- The Commission, in consultation with the Texas Natural Resource Conservation Commission, the Texas Department of Transportation, and the Industry Advisory Committee, by rule shall adopt guidelines for the required use of xeriscape on state property associated with the construction of a new state building, structure, or facility that begins on or after January 1, 1994. The commission shall develop a five-year program for phasing in the use of xeriscape on state property associated with a state-owned building, structure, or facility on which construction began before January 1, 1994. (T.S. § 2166.404-2166.405)

- The State Energy Conservation Office shall develop and provide energy and water conservation information for the state. The Office may establish procedures and adopt rules relating to the development and implementation of energy and water conservation practices and programs applicable to state buildings and facilities. (T.S. § 447.002)

- The State Energy Conservation Office shall establish and publish mandatory energy and water conservation design standards for each new state building or major renovation project, including a new building or major renovation project of a state-supported institution of higher education. Procedural standards for water conservation must address water conserving fixtures, appliances and equipment; water-conserving landscape irrigation equipment; landscaping

practices, such as landscape contouring and soil amendments, that increase water-holding capacity of soil; rainwater harvesting equipment; equipment for recycling or reusing water originating on the premises or from other sources; equipment needed to capture water from nonconventional, alternate sources; and metering equipment needed to segregate water use in order to identify water conservation opportunities or verify water savings. (T.S. § 447.004)

- The State Energy Conservation Office may also provide additional energy and water services, including technical assistance and training of designated employees in energy and water management, energy/water-accounting techniques, and energy/water efficient design and construction. (T.S. § 447.006)

- The Board on request shall assist counties and municipalities by providing a model Xeriscape code and other technical assistance. The board shall work with counties and municipalities to promote, through educational programs and publications, the use of Xeriscape in existing residential and commercial development. (T.S. Chapter 373)

- Before the Board grants a water supply project application or provides any funds under an application, it shall require the applicant to adopt a program of water conservation for the more efficient use of water. (T.W.C.§ 17.125 (b) The program may include but is not limited to:

    - Restrictions on discretionary water uses, such as lawn watering;

    - Plumbing code standards for water conservation in new building construction;

    - Retrofit programs to improve water use efficiency in existing buildings;

    - Educational programs;

    - Universal metering;

    - Conservation-oriented water rate structures;

    - Drought contingency plans; and

    - Distribution system leak detection and repair.

- Beginning May 1, 2005, all water conservation plans required under this section must, with certain exceptions, include specific, quantified 5-year and 10-year targets for water savings, established by the entity preparing the plan. (§ 17.125)

Texas Water Development Board Rules

Ground Water Management (Chapter 356 T.A.C.): [Ground water] Districts are required by Texas Water Code (§ 36.1071 § 36.1072) to submit to the executive administrator a management plan within two years after the creation of the district (§ 356.3 T.A.C.). The plans must include management goals that address, among other elements, provision of the most efficient use of ground water, controlling and preventing waste of ground water, and conservation. Specific and quantifiable management objectives must be established, along with performance standards for each management objective. These goals, standards, and objectives are established by each district based on specific needs of that district. (§ 356.5 T.A.C.)

Designation of ground water management areas are designated and delineated by the Texas Water Development Board (§ 356.22 T.A.C.)

Texas Water Development Board rules provide specific guidance regarding regional water planning (§ 357.5 T.A.C.). In developing regional plans, regional water planning groups must incorporate, among many other elements, water conservation planning and drought contingency planning, and consider existing plans and information. Regional plans must also evaluate all management strategies the regional water planning group determines to be potentially feasible, including water conservation practices for each user group (§ 357.7(7) T.A.C.). Rules for state water plan development further refine guidelines and requirements for the state water plan. Regional water plans are incorporated into the state water plan. (§ 358.3 T.A.C.)

Rules for the Agricultural Water Conservation Program (authorized by Texas Water Code § 17.899) establish a mechanism for grants, linked deposits, and loans to be provided for the development of certain conservation programs or projects (§ 367.1-§ 367.26 T.A.C.)

Texas Commission on Environmental Quality Rules

Water Conservation and Drought Contingency Plans: An entity applying for a new water right or an amendment to an existing water right must prepare and implement a water conservation/drought contingency plan, and submit that plan with the application.

The Texas Commission on Environmental Quality is required to determine whether requested appropriations of state water are reasonable and necessary for the proposed use(s), and that water right applicants will conserve and avoid wasting water. This determination is made through reviewing the applicant's water conservation plan and is considered in the decision to approve or deny a water right application.

In addition to water right applicants, the following entities are required to develop, implement and submit water conservation plans that meet the requirements:

- Municipal, industrial/mining and other non-agricultural water right holders of 1,000 acre-feet of water per year or more; and
- Agricultural water right holders of 10,000 acre-feet of water per year or more. In addition, all wholesale and retail public water suppliers and irrigation districts are required to develop drought contingency plans.

The amended Texas Administrative Code Title 30, Chapter 288 became effective on October 7, 2004. The revised Chapter 288 Rules require specific, quantified five and ten year targets for water savings to be included in all water conservation plans and the adopted plans to be submitted to the Texas Commission of Environmental Quality by May 1, 2005, and thereafter by May1, 2009 to coincide with the regional planning process. Plans must be developed by municipal users, wholesale public water suppliers, agricultural users, and industrial/mining users.

Planning by Public Water Suppliers

Plan requirements for municipal water use by public suppliers include the following elements:

- Specific, quantified 5 and 10-year conservation targets;
- Metering devices should be accurate plus or minus 5.0 percent and account for the amount of water diverted from the source of supply;
- Program for universal metering, meter testing and repair, and periodic meter replacement;
- Measure to determine and control unaccounted-for water;
- Continuing public education and information;
- Non-promotional rate structure, i.e., a rate structure which is cost-based and does not encourage excessive use of water;
- Reservoir systems operations plan, if applicable providing for the coordinated operation of reservoirs owned by the applicant;
- Enforcement procedure and plan adoption: a copy of ordinance, resolution, or tariff indicating official adoption of plan and a description of the authority under which water supplier will implement and enforce the plan; and
- Documentation of coordination with the regional water planning group(s).

For suppliers serving populations of 5,000 or more or a projected population of 5,000 or more within 10 years, the following additional requirements apply:

- Program for leak detection, repair, and water loss accounting; and

- Record management system to record water pumped, water deliveries, water sales, and water losses.

Water Conservation Initiatives

Texas State Water Plan

By statute (§ 16.051), the Texas Water Development Board must, by January 5, 2002 and before the end of each successive five-year period, develop a state water plan that incorporates the regional water plans approved under section 16.053. "The state water plan shall provide for the orderly development, management, and conservation of water resources and preparation for and response to drought conditions, in order that sufficient water will be available at a reasonable cost to ensure public health, safety, and welfare; further economic development; and protect the agricultural and natural resources of the entire state."

Regional Water Plans

Regional water planning groups in designated regional planning areas prepare the regional water plans in accordance with detailed statutory requirements. The Board designates areas for which regional water plans are to be developed. No later than 60 days after the designation of these areas, the Board must designate an initial coordinating body for planning. That coordinating body may then designate additional representatives to serve on the regional water planning group, to ensure adequate representation from a wide variety of interests comprising the region. The Board shall also provide guidelines for the consideration of existing regional planning efforts and for the format in which information will be presented. Concerning water conservation specifically, regional plans must include consideration of "all potentially feasible water management strategies, including but not limited to improved conservation, reuse, and management of existing water supplies, acquisition of available existing water supplies, and development of new water supplies." (§ 16.053)

Local Water Planning

…"Ground water districts are the state's preferred method of managing ground water resources. It is the policy of the state that water resource management, water conservation, and drought planning should occur on an ongoing basis. The Board, Commission, and Parks and Wildlife Department shall make available where appropriate technical and financial assistance for such planning. In addition, the Department of Agriculture may provide input and assistance, as appropriate, for local water planning." (§ 16.054)

Water Conservation Implementation Task Force: Report to the 79th Legislature, November 2004

This report summarizes the activities of the task force created in 2003 by Senate Bill 1094 to address water conservation efforts in the state. The Task Force was directed by the bill to review, evaluate, and recommend optimum levels of water use efficiency and conservation for Texas and to concentrate on issues related to (1) best-management practices, (2) implementation of conservation strategies contained in regional water plans, (3) a state-wide public-awareness program, (4) state funding of incentive programs, (5) goals and targets for per-capita water use considering climatic and demographic differences, and (6) evaluation of state oversight and support of conservation.

The Task Force developed a best management practices (BMPs) guide consisting of 21 municipal, 14 industrial, and 20 agricultural BMPs. These practices are voluntary efficiency practices that save a quantifiable amount of water, either directly or indirectly, and that can be implemented within a specified timeframe, and are not exclusive of other conservation techniques. "The Task Force firmly believes that applying a mandatory set of BMPs throughout Texas would not be appropriate. One size does not fit all in a state characterized by wide variations in climate, geography, municipal demographics, water utility and service profiles, and agricultural and industrial needs. State policies adopted to guide the implementation of water conservation, including water reuse, in Texas must acknowledge the fundamental decision-making primacy and prerogative of Planning Groups, municipalities, industrial and agricultural water users, and water providers." (Task Force Report, 2004)

Texas References

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Texas Water Development Board (TWDB), http://www.twdb.state.tx.us. Accessed April 2005.

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Appendix B

GEORGIA WATER CONSERVATION INTITIATIVES SURVEY

As you know, Georgia is embarking on a period of long-term water planning and policy-making unlike any before. Water conservation is at the forefront of these efforts. Water conservation is the "beneficial reduction in water use, waste, and loss" - and is proven to be the most economical and environmentally protective management tool for meeting water supply challenges.

Please help us identify Georgia's ***active statewide*** water conservation initiatives. Once the survey responses are collected, we will include them in reports being generated to support the Comprehensive Statewide Water Management Plan. Please contact Alice Miller Keyes at 404-656-4713 if you have any questions.

Thank you for your time!

1) Name of Organization:
   _____

2) Organization's overall role regarding water management:
   _____
   _____

3) Does your organization have a program or initiative related specifically to water conservation? Check all that apply:

   ___ No water conservation initiatives
   ___ Advocacy
   ___ Education or outreach
   ___ Funding or financial assistance
   ___ Research or planning
   ___ Technical assistance
   ___ Other (please describe)

4) Please describe your water conservation initiatives and any organizational policies related to water conservation. (Please include which water use groups your initiatives target and how long they have been active.)
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

5) In addition to the organizations listed on the following page, are you aware of additional groups that play an active role in water conservation? If so, please add their name and contact person.

6) Does your organization or agency have a contact person or program manager for water conservation?
Name: _____ Phone Number: _____
Email: _____

Please return this survey to Alice Miller Keyes at
alice_keyes@dnr.state.ga.us by **June 30, 2005**

Appendix C

GLOSSARY

Acre-foot: the amount of water that would cover an acre of land to a level of one foot in depth (325,851 gallons). Large quantities of water may be expressed in terms of acre-feet per year (AFY).

Aquifer: a geologic formation that contains sufficient saturated materials to be capable of storing water and transmitting water to a well.

Artificial recharge: intentional addition of water to an aquifer by direct injection or infiltration from spreading basins.

Baseline information: starting point information.

Best management practices (BMPs): a collection of methods, procedures, techniques, or use of technology that are widely accepted as beneficial in achieving specific or general goals.

Conservation measures: specific activities and programs to be implemented by water users, water managers, state officials, and/or water providers. (Used synonymously with "conservation practices.")

Conservation practices: specific activities and programs to be implemented by water users, water managers, state officials, and/or water providers. (Used synonymously with "conservation measures.")

Conservation pricing: any of a variety of rate structures for water pricing that encourages customers to reduce water use.

Conservation targets: goals for reducing water waste, loss, and/or use.

Consumptive water use: water use that results in a reduction in the amount of water from its withdrawal point to its discharge point, usually as a result of evaporation or use of the water in a product.

Demand management: mechanisms generally implemented by governments or water utilities to reduce water demand.

Declining (or decreasing) block rate: tiered rate structure for water pricing in which the lowest tier of use has the highest cost per gallon and the highest tier of use has the lowest cost per gallon.

Effluent: water, wastewater, or other liquid that has been collected for treatment.

Evapotranspiration: the collective loss of water through transpiration from plants and evaporation from land and water surfaces.

Flat rate: rate structure for water pricing that is the same for each customer, regardless of the amount of water used; the price per gallon decreases as consumption increases.

gpd: gallons per day; a standard measurement of water withdrawal and use.

gpcd: gallons per capita per day; measurement of how individuals and households are using water on a daily basis and generally where potable water is being used.

Graywater: untreated water from sinks, dishwashers, or clothes washers in households or small businesses. Graywater may be used for irrigation or certain industrial purposes.

Ground water: water under the surface of the earth in a saturated geologic structure. (Ground water does not include water flowing in underground streams with ascertainable beds and banks.)

Ground water mining: overpumping (or overdrafting) ground water such that withdrawals exceed recharge over time.

Inclining (or increasing) block rate: tiered rate structure for water pricing in which the lowest tier of use has the lowest cost per gallon and the highest tier of use has the highest cost per gallon.

Industrial use: a non-irrigation use of water not supplied by a city, town, or private water company, including animal industry use.

Information targets: targets that enhance understanding about water use and conservation efforts.

Instream flow: water in rivers and streams. Certain levels of flow are required for aquatic habitat, recreation, navigation, and waste assimilation.

Membrane (water) treatment: water treatment that involves passage of water through a usually thin membrane that prohibits the passage of particles larger than a certain size.

Municipal use: non-irrigation uses of water supplied by a city, town, or private utility.

Offstream uses: water withdrawn or diverted from a source and transported to a place of use; includes public supply, commercial, industrial, mining, irrigation, and thermoelectric power generation.

Peak (water) demand: the point(s) of greatest water use experienced by a water supply system. Peaks can be measured daily, monthly, or annually.

Per capita (water) use: the amount of water used by one person, usually expressed in terms of per capita per day (pcd), or how much water one person uses in one day.

Permitted capacity: the total amount of water use allowed by a sector or an individual withdrawal permit holder.

Potable water: water that is suitable for drinking, cooking, and household needs.

Pressure reducer (or regulator): a device used to reduce the water pressure in a water transmission pipe.

Rain sensor: a device that automatically shuts off an irrigation system in the event of a rain event.

Recharge: the natural or artificial (intentional) addition of water to an aquifer.

Reclaimed water: wastewater that has received treatment to urban water reuse standards and meets specified treatment criteria. (Reclaimed water is generally treated to non-potable standards.)

Reuse: the beneficial use of previously used and treated water (reclaimed wastewater) as a substitute for another generally higher quality water source. Direct reuse is the use of treated water before it is disposed or discharged into a water course, lake, or other body of water. Indirect reuse uses a water course or body of water for transport of return flows as part of a reuse project.

Reuse feasibility studies: assessments of the feasibility of using reclaimed water to help minimize water withdrawals.

Reverse osmosis: a membrane-based water treatment process that removes all dissolved solids from water.

Safe yield: the maximum amount of surface water or ground water that can be withdrawn over time without damaging the resource; or, the amount of ground water that can be withdrawn without exceeding the recharge rate.

Salt water intrusion (or salt water encroachment): the movement of saline water into a fresh ground water or surface water body.

Seasonal rate: rate structure for water pricing in which the price per gallon of is uniformly higher during periods of peak seasonal demand, typically during summer months due to landscape irrigation. Rates during the remaining months of the year are uniform.

Seasonal surcharges: excess-use charges added to the base water rate during peak water use periods.

Sliding scale: used to demonstrate the relationship between the characteristics of a water resource and some measure of response from those using the resource.

Source management: the amount of water we take from a water body and the amount used for specific purposes.

Submeter: a water meter that measures unit water use within a larger service connection, such as a process within an industrial facility or an apartment within a larger complex.

Subsidence: the settling or lowering of the surface of the land which may result from the overdraft of ground water.

Surface water: floodwater and waters flowing in streams, ravines, defined underground channels or other natural channels, and water in lakes, ponds, and springs on the surface.

Toilet displacement device: a devise (typically a brick, bottle, or bag) used to displace water in a toilet tank in order to reduce the volume used for flushing.

Unaccounted-for water: water that is treated for delivery by a water utility but not billed (water that is lost by leakage, theft, or is unmetered).

Uniform rate: rate structure for water pricing in which the rates are the same for all customers and all levels of consumption: the per-gallon price of water remains constant.

Unmetered water: water that is delivered by a water utility but not measured for billing.

Wastewater: used water or drainage from homes, businesses, industries, or institutions.

Water audit: an on-site assessment of water use, including hardware and equipment that uses or delivers water, landscaping and water management practices, and other factors, for the purpose of assessing the potential for improving water use efficiency.

Water banking: a method for allocating currently unused water to future water needs.

Water budget: a water allocation based on established water efficiency standards. Water budgets may be established for agricultural, industrial, and other uses.

Water conservation: beneficial reduction in water use, water waste, and/or water loss

Water conservation goals: specific or programmatic goals, under the water conservation management objectives, that all water users can work toward to reduce water usage.

Water conservation practices: specific activities and measures to be implemented by water users, water managers, state officials, or water providers.

Water conservation targets: goals for reducing water waste, loss, and/or use.

Water consumption: water use that results in a reduction in the amount of water from its withdrawal point to its discharge point.

Water efficiency: achieving a water use function with the minimal amount of water possible.

Water reclamation: the treatment of wastewater to make it reusable, generally for nonpotable purposes.

Water reuse: the beneficial use of previously used and treated water (reclaimed wastewater) as a substitute for another generally higher quality water source. Direct reuse is the use of treated water before it is disposed or discharged into a water course, lake, or other body of water. Indirect reuse uses a water course or body of water for transport of return flows as part of a reuse project.

Water use: water actually used or consumed for a specific purpose.

Water use and conservation profiles: used to account for statewide water usage and to estimate potential water savings from standard water conservation practices.

Water withdrawal: water taken from a natural or manmade water body.

Well: a man-made opening in the earth through which water may be withdrawn or obtained from beneath the surface of the earth, with certain exceptions.

Xeriscape ™: a trademarked term used to describe the selection, planting, and care of low-water-use landscape plants, shrubs, and trees.