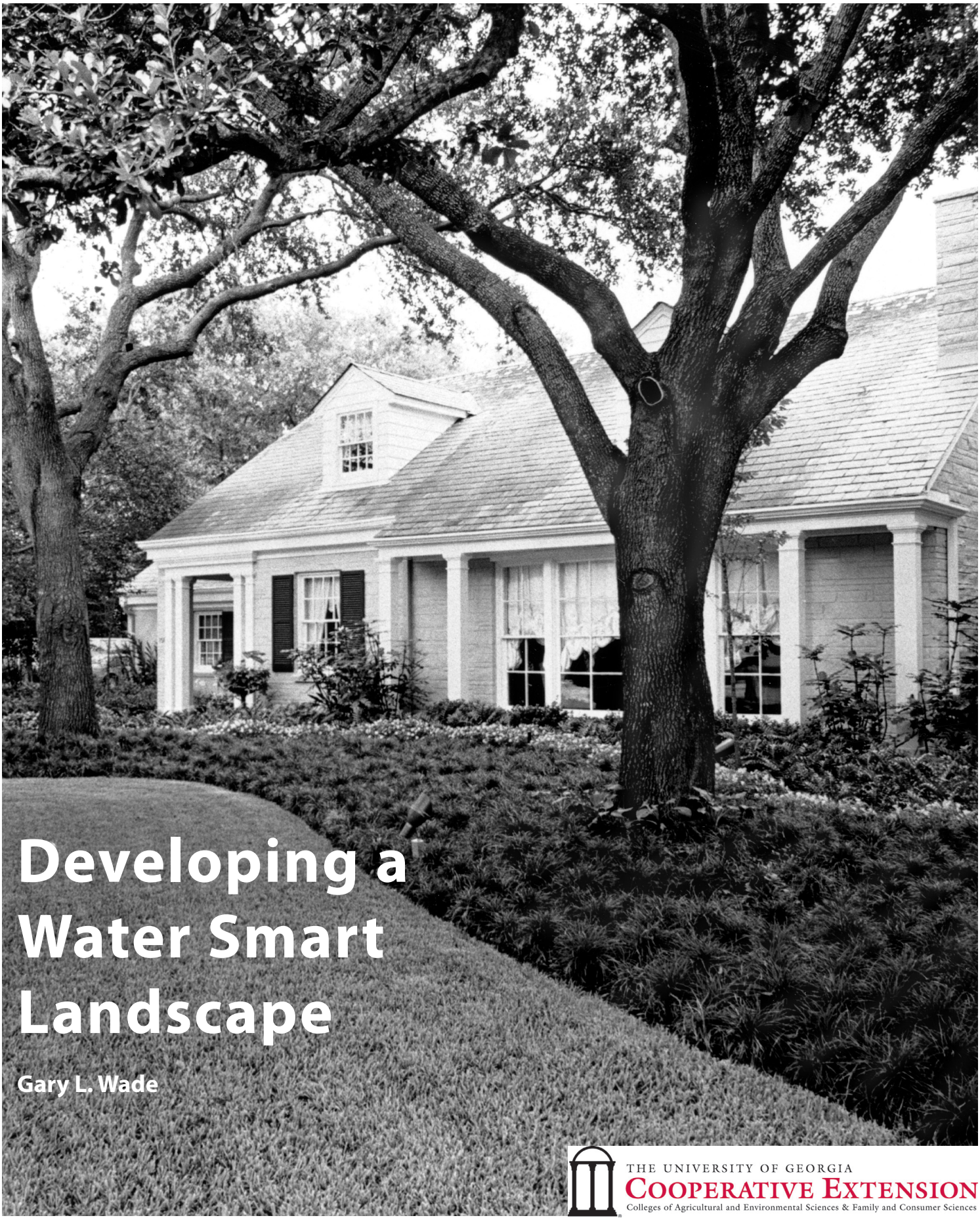

Developing a Water Smart Landscape

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Colleges of Agricultural and Environmental Sciences & Family and Consumer Sciences

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INTRODUCTION

Today, Georgia is facing a serious water supply problem in several urban areas as population growth causes an ever-increasing strain on available water supplies. People are migrating to urban areas for the schools, health care, and goods and services they offer. As a result, over half of the state's 10.1 million residents (2010 Data) reside in just 12 urban counties, while two-thirds of the population lives in just 24 of 159 counties.

Increasing demand for water corresponds to increasing population growth. Table 1 shows population and water demand projections for five counties in northeast Georgia. Similar statistics can be shown statewide for counties in and around urban areas.

Increasing demand for water results in periodic water shortages and restrictions on outdoor water use. Periods of limited rainfall or drought make the problem worse. From 1998 to 2002 and from 2006 to 2008, Georgia experienced two of the worst droughts on record, and restrictions and bans on outdoor water use were common throughout the state. In May 2004, state officials implemented permanent, yet voluntary, odd/even restrictions on outdoor water use to encourage conservation year round. Then, on June 2, 2010 the Georgia Water Stewardship Act went into effect statewide. It allows daily outdoor watering for purposes of planting, growing, managing, or maintaining ground cover, trees, shrubs, or other plants only between the hours of 4 p.m. and 10 a.m. if the water source is from a municipal supply. Persons irrigating from private wells are exempt from these requirements. For more information, see http://www.gaepd.org/Documents/outdoorwater.html

Household water use increases dramatically during the summer months when irrigation water is applied to the lawn, garden and landscape. In some households, water use may be as much as 60 percent higher in summer than in winter.

"During the 2007 record drought, Georgia still received over 30 inches of rain. Although this was well below normal, it was more rain than two-thirds of the U.S. gets annually. We need to learn how to better manage the water resources we have".

Dr. Carol Couch, former Director, GA Dept. of Natural Resources

XERISCAPE™

Tremendous amounts of water may be used outdoors. A typical portable lawn sprinkler applies about 300 gallons of water per hour of operation. Some residential landscapes receive several times this amount of water two to three times a week during the summer. As a result, much water is lost to evaporation or run-off, or it is simply wasted when plants are given more water than they need.

In 1981, a national movement began in Colorado. It was called Xeriscape (pronounced Zera-scape), which means quality landscapes that conserve water and protect the environment. It was derived by merging the Greek word "**Xeros,"** meaning dry, with the word "landscape."

The Xeriscape concept, from its inception, has been a collection of seven common-sense landscape practices (or steps) that can be applied in every phase of the landscape scheme, from design to installation and maintenance. Each step builds on the one before it, and when applied collectively, optimum water-use efficiency and water conservation can be achieved.

Table 1. Population and water demand projections for five northeast Georgia counties[z]

County	2000 Population	2030 Population	% Change	2000 Water Demand[y]	2030 Water Demand[y]	% Change
Barrow	46,144	173,750	277%+	5.03	23.68	371%+
Clarke	101,489	181,340	79%+	13.67	25.26	85%+
Jackson	41,589	138,480	233%+	3.67	15.88	333%+
Oconee	28,225	51,870	84%+	2.46	9.56	289%+
Walton	60.687	213,880	252%+	6.17	27.91	352%+

[z] Source: Northeast Georgia Regional Development Council
[y] Million of gallons per day

Today, in Georgia and many other states, the Xeriscape concept has been re-named "Water Smart" to make it a more identifiable and environmentally familiar name. The following are the seven steps for developing a Water Smart landscape:

A Water Smart landscape can reduce outdoor water consumption by as much as 50 percent without sacrificing the quality and beauty of the home environment. It is an environmentally-sound landscape, requiring less fertilizer and fewer chemicals. A Water Smart landscape also is low maintenance - saving time, effort, and money.

Any landscape, whether newly installed or well established, can be made more water efficient by implementing one or more of the seven steps. It is not necessary to totally redesign the landscape to save water. Significant water savings can be realized simply by modifying the watering schedule, learning how and when to water, using the most efficient watering methods, and learning about the different water needs of plants in the landscape.

The following is a detailed look at each of the seven Water Smart steps.

STEP 1: Planning and Design

Whether developing a new landscape or renovating an existing landscape, proper planning and design are important. It is particularly important when developing a Water Smart Landscape. Before selecting plants, first solve any environmental and physical problems in an attractive and practical manner. Think about the various areas of the landscape in terms of how they should be developed for different uses, and how much space should be allotted to each area.

As you plan each area, consider several different arrangements. For example, is a fence, wall or hedge more appropriate for screening and/or security? How much space is needed for active recreation, a vegetable garden, or patio entertaining? After these decisions are made, begin thinking about what plants to use.

Begin with a Base Map. A base map is a plan of the property drawn to scale on graph paper showing the location of the house, its orientation to the sun, other structures on the site, and unusual features, such as stone outcroppings and existing vegetation (see Figure 1). Accuracy in the base map will help determine if the site will accommodate all current and future plans. Later it will help to determine the quantity of any construction materials and plants needed.

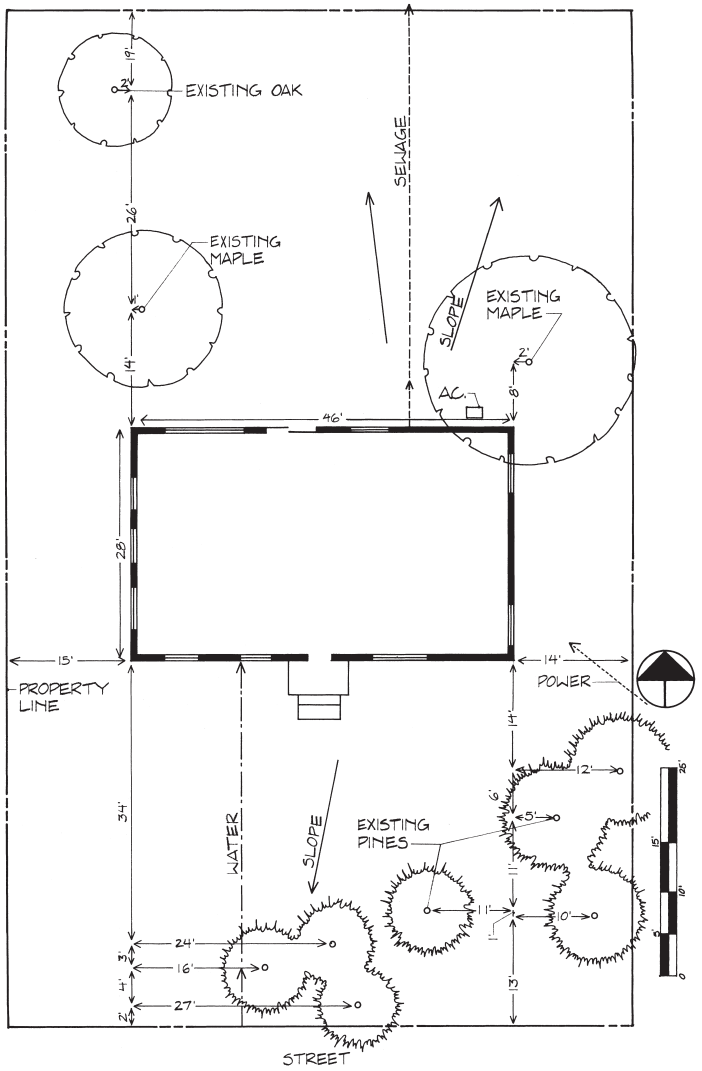


Figure 1. Base map of property

Catalog Site Characteristics. The next step is to lay a sheet of tracing paper over the base map and label it "Site Analysis" (see Figure 2). Use arrows to indicate the direction of desirable views to be emphasized and undesirable views to be screened. Use other arrows to indicate the drainage patterns of the property, including any low spots or eroded areas. Make plans to correct potential drainage problems before planting. This may require re-grading, bringing in additional soil, building retaining walls, or shaping terraces. Any changes in the existing landscape should be subtle so that the natural character of the landscape is retained.

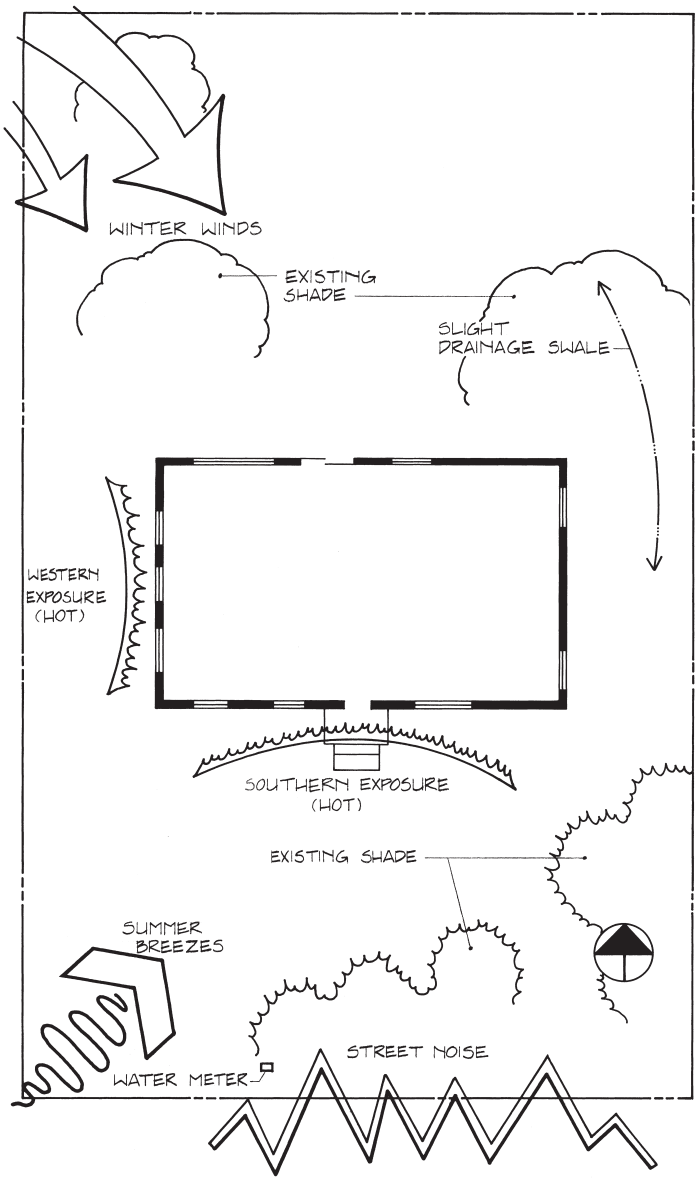


Figure 2. Site analysis of property

Incorporate as many of the natural elements of the site into the design as possible, such as existing trees and shrubs. Incorporate as many undisturbed native areas into the design as possible. Undisturbed areas of native vegetation will not require supplemental irrigation.

Note the orientation of the home (north-south-east-west). This will help determine where to locate plants best suited for sun or shade. Areas exposed to direct afternoon sun are likely to dry out more rapidly than those in the shade. In these locations, the plan should include drought-tolerant plants, some method of providing supplemental water, or cultural practices that will help conserve moisture.

Incorporate Shade Into the Design. Shade from trees or structures in the landscape keeps the landscape cooler in summer and reduces water loss while creating a comfortable living environment. A shaded landscape can be as much as 20° F cooler than one in the full sun. Figure 3 compares the heat exchange in an unshaded parking lot, where the soil surface is covered by pavement, to a tree in dry soil and a tree in moist soil.

A shaded landscape may be 20° cooler than a landscape in full sun.

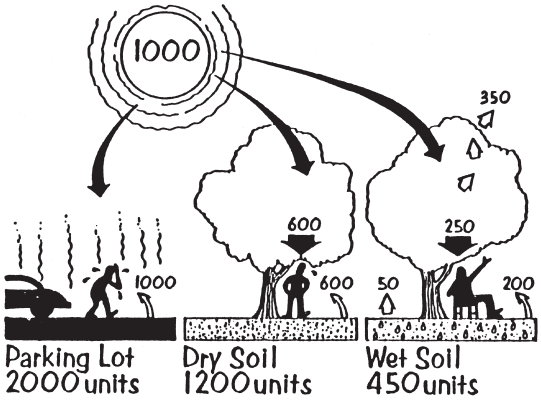


Figure 3. Effects of shade on water loss

A person standing in an open parking lot is bombarded with 1,000 heat units from the sun and another 1,000 heat units reflected from the paved surface. Walking beneath a shade tree provides immediate relief from the sun as the tree acts like an umbrella, blocking light and heat (passive shade). If the tree is growing in moist soil, it will not only block heat but will also dissipate heat by evaporative loss from the leaves (active shade). A moist soil surface also evaporates heat and reduces heat load further. Therefore, a moist landscape with trees can contain one-fourth as much heat as a parking lot in full sun and one-half as much heat as a bone-dry landscape.

In addition to paved areas, shade prevents heat build-up from other hardscape surfaces, such as brick or stucco walls and gravel walks. Whenever possible, shade these surfaces.

Just as we perspire and lose moisture through our pores, plants transpire and lose moisture through their leaves. A mature oak tree, for example, can dissipate as much heat as four home central air conditioners running 24 hours per day. This evaporative water loss from leaves has a cooling effect on the environment and cooler temperatures, along with increased humidity result in less water loss from surrounding plants. Therefore, effective shading makes the landscape more water-efficient, the main objective of a Water Smart plan.

Effective shade management in a Water Smart landscape involves using shade to block sunlight from striking the soil surface and to intercept, scatter, and reflect radiant energy to protect paved surfaces or masonry structures from direct sunlight. Effective shade management also involves managing wind currents that influence heat flow and water loss in the landscape. In addition to trees, structures like trellises, arbors, walls, or fences can provide shade. A vine or espalier on these structures improves their shading and cooling effect.

Plan for Different Use Areas. To begin the plan, overlay the base map and site analysis sheet with another piece of tracing paper. On this sheet indicate the public, private and service areas of the landscape (see Figure 4). Consider how these areas will be developed, based on space requirements for each activity. The public area is the highly-visible area that most visitors see, such as the entry to the home. In a traditional landscape, this area typically receives the most care and the most water. Therefore, the careful design of this area is important for water conservation. It is possible to design this area to require minimal water and maintenance without sacrificing quality or appearance.

The private area of the landscape, usually the backyard, is where most outdoor activity occurs. It is generally the family gathering area. It may also include a vegetable garden or fruit orchard. The landscape in this area needs to be functional, attractive, and durable, but it also should be designed to require less water than the public area of the landscape. The service area is the working or utility area of the landscape, an area usually screened from view and containing such items as garbage cans, outdoor equipment, and air-conditioning units. In terms of routine maintenance, this area would be designed to require the least care and water of the three areas.

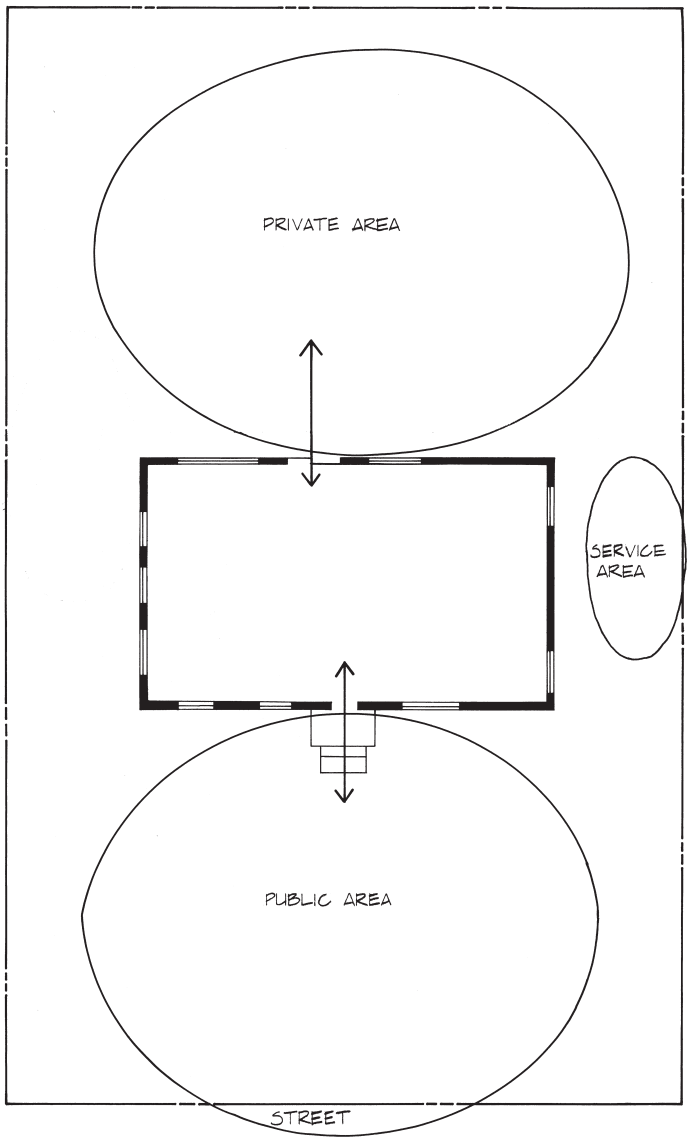


Figure 4. Basic use areas of a typical residential landscape

Establish Water-use Zones. In addition to dividing the landscape into use areas, a Water Smart plan further divides the landscape into three water-use zones: **high** (regular watering), **moderate** (occasional watering), and **low** (natural rainfall) (see Figure 5). There may be several of these zones within an individual landscape. High water-use zones are small, highly-visible, and highly-maintained areas of the landscape, such as the public area and the area around the patio where plants are watered regularly in the absence of rainfall. In the moderate water-use zones, established plants are watered only when they turn a grey-green color, wilt, or show other symptoms of moisture stress. Possible plants for this zone include azalea, dogwood, redbud, Japanese maple, and many herbaceous perennials. Plants in the low water-use zones are not irrigated, except during extreme droughts when plant survival is in jeopardy.

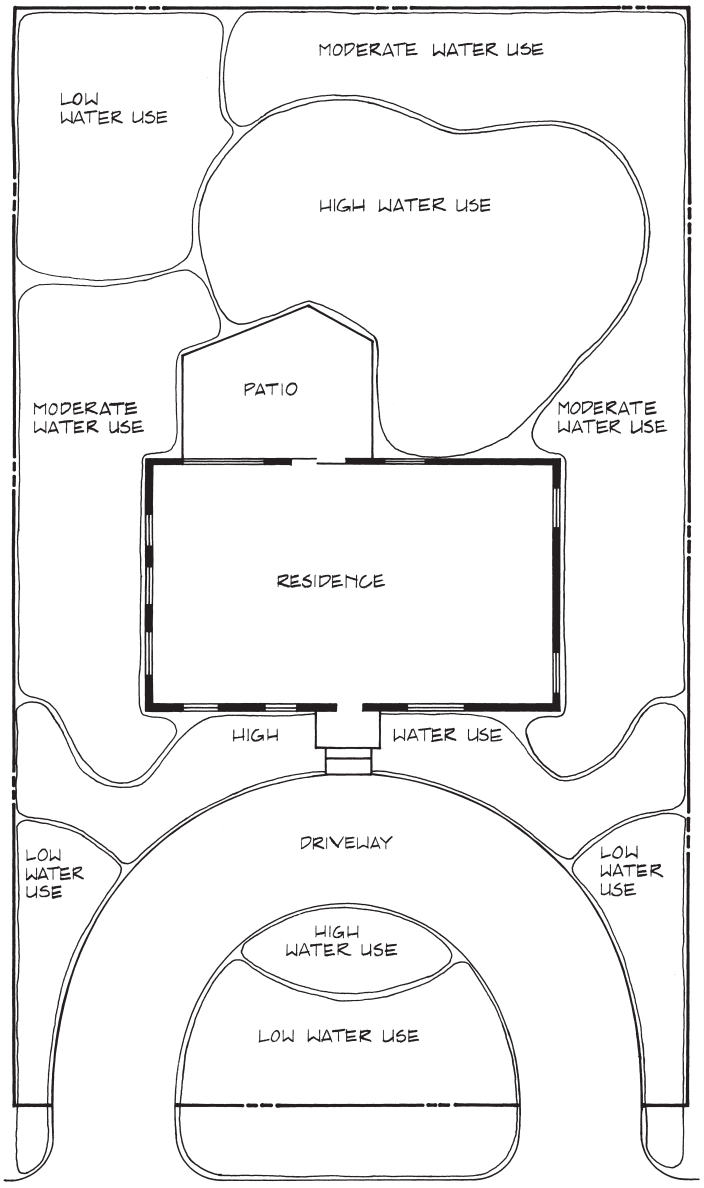


Figure 5. Diagram of water-use zones of a property

Newly-planted ornamental plants and turfgrasses require regular irrigation during the establishment period (8 to 10 weeks after planting), regardless of their intended water-use zone.

For greatest water conservation, design as much of the landscape as possible into low water-use zones. Most people are surprised to learn that many woody ornamental trees and shrubs, turfgrasses, some herbaceous perennials, and even some annuals, grow well in low water-use zones where they are not irrigated after they are established.

To maximize water savings, concentrate seasonal color beds in areas of the landscape where they can be watered and maintained. Avoid scattering a number of small color beds throughout the landscape. Consider placing seasonal color in containers instead of beds. Containers can be more efficiently watered than beds, and they can be moved to areas where high impact color is needed.

Add a new overlay of tracing paper and sketch the desired water-use zones. At this stage, the landscape is beginning to take shape. The form of the various beds can be visualized, even though construction materials and plants have not yet been identified.

Develop a Master Plan. After deciding on a design scheme and a water management arrangement, it is time to give form and definition to the various spaces on the plan. With the identification of planting spaces, edging materials, groundcovers, and paving, the Master Plan begins to take form. This is a plan showing the final product. Straight lines or smooth flowing curves are best —tight curves or unnecessary bends can be maintenance problems. Use right angles and avoid acute angles that are difficult to maintain and irrigate. Remember that simplicity in the design will ensure easy maintenance and water-use efficiency. A prototype Master Plan is shown in Figure 6.

Fit Plants to the Design. After achieving the desired style and overall effect, it is time to select plants to fill the assigned spaces. It is very important to select plants that complement and accent the good features of the architecture and construction materials rather than overpower them.

Group plantings to conform to the shape of plant beds. Avoid rigid, formal, geometric plantings as much as possible. A good approach for most residences is to place the larger plants at the corners with some height at the entrance and low plantings in between. Such arrangements focus attention on the entrance.

For a pleasing visual effect, use odd number groupings (1, 3, 5) when possible. Use bands of low-growing plants or ground covers to tie together and unify groups of taller shrubs.

Place plants at the proper spacing in the landscape to ensure easy maintenance and more efficient use of water It is extremely important to space plants far enough apart so that they can achieve their mature size without being crowded. Over-planting by placing plants too close together increases costs. It also causes long-term maintenance problems and inreases the potential for water stress.

Select plants that have a size and form that conform to their location without having to be sheared or frequently pruned to keep them in bounds. Plants, like people, grow in all shapes and sizes. If left unpruned, some plants will be tall and thin, while others will stay short and spreading. Some will be irregular with open branching while others will be compact with dense foliage. Choose plants with the same shape and ultimate size as the space to be filled. For example, to plant

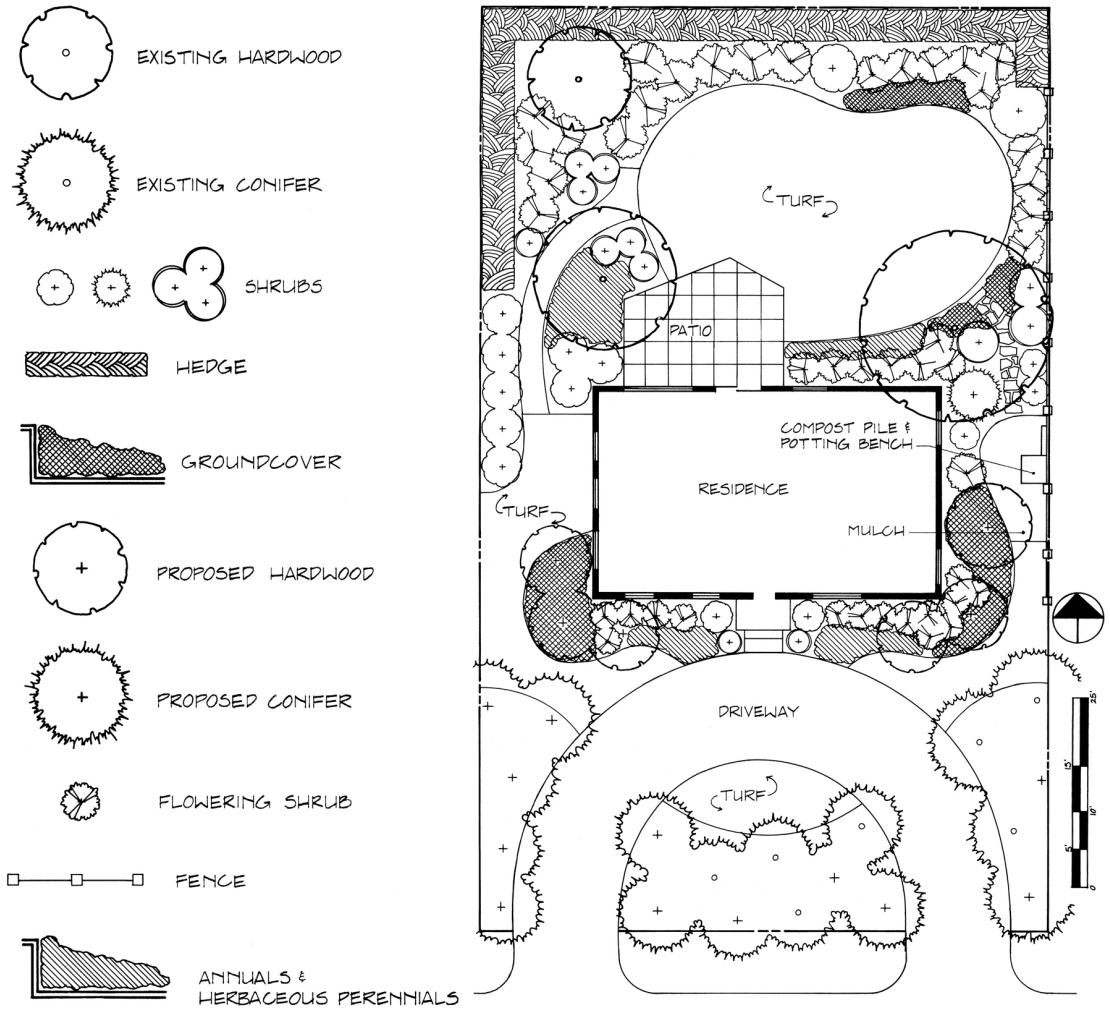


Figure 6. Master Plan for a Watersmart Landscape (Note how the character of the landscape is very similar to that of a traditional landscape)

an area in front of low windows, 2 feet above the ground, select spreading, low-growing shrubs with an anticipated height of not over 2 feet.

Avoid using too many different kinds of plants because the landscape may look like an arboretum of plants and will lack unity. For the typical home, three to five different shrubs, in addition to ground
covers and trees, are recommended for the basic plantings around the house.

Renovation of an Existing Landscape for Improved Water Conservation. Figure 7 depicts before and after views of a typical residence that has been renovated for water conservation. The before view illustrates a rather dull landscape with foundation shrubs ringing the house, a hedge along three sides, and some native trees along the rear of the property.

The redesign of the residence (after view) shows expansion of the shrub beds in the public and private areas of the landscape to provide seasonal interest, variety, and reduced maintenance. Shade-tolerant ground covers are used under the existing trees on the left side of the front and right rear of the property. A large area in the left rear of the property was made into a play area for children using mulch. Note how the water-use zones changed during the redesign of the property. The goal was to minimize the irrigated area and irrigation requirements of the landscape.

Tables 2 and 3 show an economic comparison of the landscape before and after renovation. Changes in water-use zones were projected to save over 27,000 gallons of water a year. This equated to an annual savings of $134.90 on water, $151.42 on sewage and $279.66 on landscape maintenance. Although the landscape renovation cost $1,245.00 in plants and supplies, the annual savings brought a total return on investment within 2.2 years. Therefore, a water-wise landscape not only saves water...it saves money!

The alteration of an existing landscape to conserve water does not have to be as elaborate as that shown. In many instances, it may be as simple as relocating a few shrubs or flowering trees to more environmentally-suitable locations

on the property, or improving the shape of plant beds to simplify irrigation. Considerable savings can result by converting irrigated areas to ground covers or natural mulch areas. Often large amounts of water can be saved simply by changing management practices and watering habits without making any physical changes in the landscape. For each 1,000 square feet of landscaped area converted from an irrigated to a non-irrigated area, it is estimated that more than $90 per year can be saved on annual water and sewage costs.

Table 2. Surface area by water use zone before and after renovation

Zone	Square Feet Before	Square Feet After
Low	0	3403
Moderate	5788	3403
High	3662	2509
Total irrigated area	9450	6047

* Low = not irrigated; Moderate = irrigated occasionally; High =irrigated regularly

Table 3. Estimated annual water use and anual cost of water, sewage and landscape maintenance before and after renovation

	Before	After	Savings
Water Use (gallons)	81,437	51,733	27,437
Est. annual water[1] cost	$369.84	$234.94	$134.90
Est. annual sewage[1] cost	$415.26	$263.84	$151.42
Est. annual maintenance[2] cost	$778.80	$490.14	$279.66
Overall cost	$1563.90	$697.92	$565.98

[1] Water and Wastewater Rate Survey, Metropolitan North Georgia Water Planning District. 2008. Cost based on average charge/7,000 gallons across 16 counties.
[2] HORT Management Cost Estimator. 2009. The University of Georgia Cooperative Extension Special Publication 1, Departments of Horticulture and Agricultural and Applied Economics.

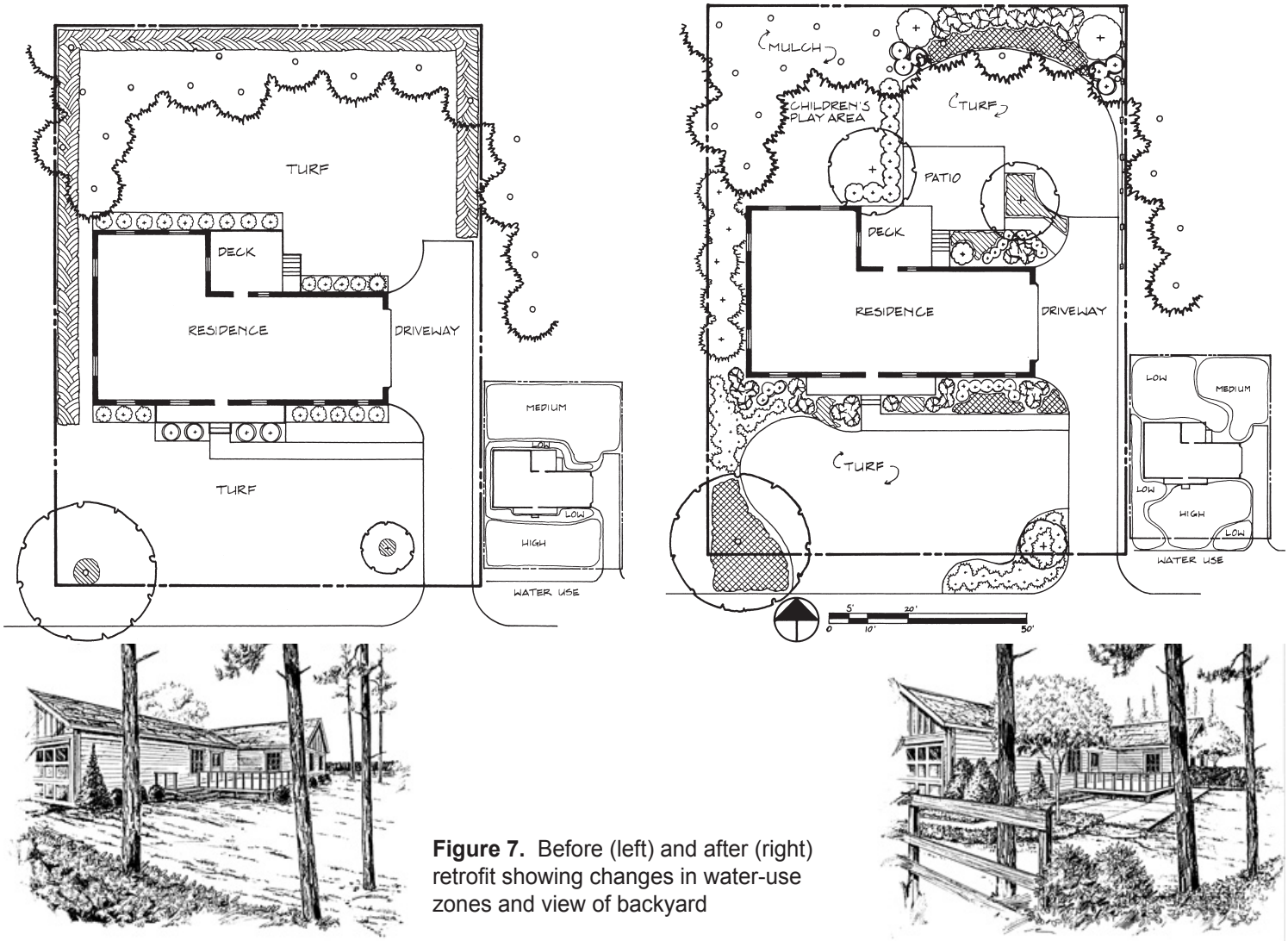


Figure 7. Before (left) and after (right) retrofit showing changes in water-use zones and view of backyard

Step 2: Soil Analysis and Improvement

Inspect The Soil. A thorough analysis of both the physical and chemical characteristics of the soil is important when developing a water-wise landscape. Georgia has a wide variety of soil types, ranging from well-drained coastal sands to poorly-drained clays. Each soil has its own unique structure and texture, drainage pattern, pH, nutrient content, and need for amendments and fertilizer. To complicate matters, there may be several different soil types within an individual landscape, or the soil may consist of fill dirt brought onto the site. Soils are seldom perfect and most of them can be improved in some way to ensure best plant growth.

The goal in a Water Smart Landscape is to create an ideal soil environment for the expanding root system. An ideal soil has good aeration and drainage, yet holds adequate moisture and nutrients for optimum root growth. Research at the University of Florida showed that the roots of trees and shrubs grow outward, approximately seven times the diameter of the root ball, during the first growing season when provided with a good soil environment.

Unfortunately, there is no "cookbook recipe" for soil improvement. Each soil is different, and plants have different requirements for moisture. How to treat the soil depends on the characteristics of the native soil, the type of plants to be grown, and the time of year when planting.

Before planting, check the structure and texture of the native soil by digging a hole 12 to 15 inches deep and examining the soil horizon. Is it loose and granular, or hard and compact? Fill the hole with water and watch how fast it drains. If water remains in the hole after 12 hours, the soil is poorly-drained.

Plants prone to drought stress, such as azalea, dogwood, annuals, and herbaceous perennials, prefer a moist, well-drained soil. On the other hand, plants known to be drought tolerant, such as crape myrtle, ligustrum, and juniper, grow well on dry sites, once established. Soil preparation for summer transplanting, when dry periods are likely to occur, should have a greater water-holding capacity than soil prepared for fall transplanting, when rainfall is generally more regular and irrigation demand is low.

Soil Analysis Saves Guesswork. Before landscaping, get your soil tested. You can either take a soil sample to the County Extension Office for sending to the State Soil testing lab (there will be a small fee for this), or you can order a soil test kit on-line at http://aesl.ces.uga.edu/soiltest123/Georgia.htm The results of the test will go back to your local county Extension agent who will provide a recommendation for lime and fertilizer based on the analysis.

Improve the Structure of Poor Soils. Certain native soils, like dense, poorly-drained clays, have such poor structure that plant growth suffers unless they are improved. Poorly-drained soils can be improved in several ways. Sometimes deep cultivation will break apart a hard layer of soil (hardpan) several inches below the soil surface and improve drainage. Another option is to bring in additional soil to raise the planting area 12 to 15 inches above the existing grade. Some professional landscapers also incorporate 3 to 6 inches of a coarse aggregate, such as coarse granite sand or pea gravel, into poorly-drained soils.

A final option is to install subsurface drainage pipe to carry excess water off the site after rain.

On the other hand, soils that tend to dry out rapidly and hold little moisture will benefit from organic matter, like compost, incorporated uniformly throughout the planting bed. This is particularly helpful when water-requiring plants, like annuals, are to be grown. For organic matter to be beneficial, apply 3 to 6 inches on the soil surface and incorporate it into the soil to a 12-inch depth.

Hydrogels, synthetic polymers that absorb hundred times their weight in water and gradually release it to the plant, are among the popular new products on the market for water conservation. One teaspoon absorbs a quart of water.

Water-absorbing polymers, commonly called hydrogels, are popular new products on the market today. They are sold under several trade names, including Terra Sorb and Hydrosource. These man-made crystals, sold under various trade names, absorb several hundred times their weight in water and gradually release it to plant roots. One pound of crystals applied to 100 square feet of bed area will absorb 20 to 25 gallons of water, or about 50 times as much moisture as peat moss. They last from six months to several years in the soil, depending on the product.

Research to date with hydrogels is limited and has provided conflicting results. However, preliminary studies with hydrogels at the University of Georgia shows them to enhance the growth of summer annuals in non-irrigated soils. Some professional landscapers use hydrogels in container plantings to extend the time between waterings. Gardeners may want to experiment with these products and judge their merits.

STEP 3: Appropriate Plant Selection

Appropriate plant selection means selecting plants that not only are compatible with the design but also are well-suited to the planting site and local environment. It involves selecting plants according to the soil type and light level of the site. Ideally, the plants selected also should be adaptable to local fluctuations in temperature and soil moisture.

Drought tolerance is important in a Water Smart landscape. However, it should not be the only criteria used to select plants. Junipers, for instance, are extremely drought tolerant, but they cannot tolerate wet soils or heavy shade. Red-tip Photinia is drought tolerant, but it is susceptible to a leafspot disease that defoliates it in summer.

Native plants are not necessarily more drought tolerant than introduced exotic species. Even though a plant may be native to the area, it may not adapt to an adverse new environment (micro-climate). To be successful with native plants, the plant's native environment must be simulated. Also, there are some native plants, such as Summersweet Clethra, Inkberry and Swamp Magnolia, that are native to moist sites and are not drought tolerant.

In addition to the adaptability of a plant to the site, several other important criteria should be considered:

1. **Mature size and form**. Will the plant remain in scale with the rest of the landscape as it matures, or will it likely overgrow the site and compete with other plants for space, nutrients and water?
2. **Growth rate**. Slow-growing dwarf shrubs and ground covers used around the base of the home require little routine pruning.
3. **Texture**. Is the leaf texture fine, medium, or coarse; does it combine well with the adjacent plants?
4. **Color**. Is the flower or foliage color compatible with other plants or the background color of the building?
5. **Functional Use**. Is the plant suitable for the location and intended purpose; i.e. under low windows, along the perimeter of the property as screening hedge, or as a ground cover?

Select healthy, vigorous plants. Examine their root systems for well-developed roots and an abundance of small white roots (absorptive roots) along the exterior of the root ball. Examine the leaves and stems for insects or diseases, and avoid plants that are weak or appear unhealthy.

When selecting plants for a Water Smart landscape, keep in mind this important fact..PLANTS DON'T SAVE WATER.... PEOPLE DO! It is not the plants that save water, but our ability to locate them in the landscape appropriately and to manage them properly that determine their water needs.

Match the water-use zones with the condition of the planting site. For instance, place high water-requiring plants in areas of the landscape that stay moist, and low water-requiring plants in areas that stay drier naturally.

Any ornamental plant or turfgrass presently on the market can be used in a Water Smart landscape. In fact, it may be surprising to learn just how many plants can thrive without any supplemental water once they are established. The key is to identify the water needs of the plant selected, then group it in the landscape with other plants having a similar need for water. By doing this, supplemental irrigation can be applied most efficiently and only to those plants that require it. The result is maximum water conservation in the landscape.

STEP 4: Practical Turfgrass Areas

Turfgrass is one of the most versatile and functional plants in the landscape. It provides one of the best recreational surfaces for outdoor activities. From a water management standpoint, turfgrass is recognized as one of the most effective plant covers to reduce run-off and erosion, while recharging the ground water, which results in more efficient use of rainfall.

Turfgrass has a tremendous mitigating effect on the environment. For example, research documents that a turfgrass area can be as much as 30°F cooler than a concrete or asphalt surface, and 10°F to 14°F cooler than bare soil. This cooling effect from the average lawn is equal to over eight tons of air conditioning while the average home central air unit produces three to four tons. Turfgrass also absorbs dust and other air pollutants, while producing oxygen.

An area of well-maintained turfgrass is like a welcome mat at this home.

However, in the typical landscape, turfgrass occupies the largest area and, when managed incorrectly, receives the largest amount of irrigation. Considerable water savings can be realized by irrigating only the turfgrass in high impact, highly visible areas of the landscape.

Maximum water conservation with turf is obtained through proper selection, establishment, and maintenance. In addition to differing in appearance, turfgrasses differ in their tolerance to environmental factors such as shade, temperature, soil fertility, water use, and drought resistance. Table 4 shows water use and drought resistance of some turfgrass species and varieties tested in Georgia. The water use is based on the user following recommended irrigation practices. Drought resistance is important when growing turfgrass in non-irrigated areas, although the turfgrasses listed would survive most droughts in Georgia.

Practical turfgrass areas means using turfgrass for a specific function in the landscape. A small "oasis" of turf near the entrance to the home, a playing surface of durable turfgrass in recreational areas, or a blanket of turfgrass on a highly erodible slope are all examples of "practical" turfgrass areas. Also, design turfgrass in practical shapes that can be efficiently irrigated and maintained. Avoid sharp angles and long narrow strips that are difficult to mow and water.

Remember, the goal in developing a Water Smart landscape is to reduce the need for supplemental irrigation, regardless of whether it is in turfgrass or ornamental areas of the landscape. As irrigated space is reduced, water savings increase.

Table 4. Average water use and drought resistance of selected turfgrasses in Georgia

Common Name	Water Use	Drought Resistance
Tifway Bermudagrass	very low	very high
Common Bermudagrass	very low	very high
Raleigh St. Augustinegrass	very low	very high
Rebel II tall fescue	very low	medium
Centipedegrass	low	med-high
Meyer zoysiagrass	low	low
K-31 tall fescue	low	low-med

STEP 5: Efficient Irrigation

A Water Smart landscape requires a minimal amount of supplemental water from irrigation. When irrigation is used, water is applied efficiently and effectively to make every drop count.

Just as plants are zoned in the landscape according to their different water needs, zone the irrigation system so that plants with different water needs are irrigated separately. For instance, water turfgrass separately from shrubs and flowers.

The efficient use of irrigation water also requires the selection of the appropriate type of irrigation for the plants in each irrigated area of the landscape. Trees and shrubs in the low water-use zone would need supplemental water only during establishment (first 8 to 10 weeks after transplanting), while plants in moderate water-use zones require water only during periods of limited rainfall when they show signs of stress. For these plants, a temporary system such as a soaker hose or hand watering may be all that is required. Conversely, high water-use zones require frequent watering and may warrant a permanent system with automatic controls. Whenever possible, use highly efficient watering techniques, such as drip irrigation.

Sprinkler Irrigation. Sprinkler irrigation may be as simple as a single sprinkler attached to a garden hose, or it may be a complex system of underground pipes and pop-up spray heads with automatic controls. A Water Smart landscape uses sprinkler irrigation for watering turf where water must be applied uniformly over the entire area. For most other applications in the landscape, drip irrigation is a better choice.

There are many types of sprinklers available for use in the landscape. Permanent systems with pop-up type spray heads are most common. They are installed underground and rise above the ground surface to operate. Some are designed for use in turf (2- to 3-inch pop-up height), while others are designed for use in beds of taller plants (6- to 12-inch pop-up height). Some sprinkler heads are designed for watering small, irregular-shaped areas. These typically have a radius of 15 feet or less. Others, like rotary sprinkler heads, wet a radius of 20 to 50 feet and are used to irrigate large areas. Most sprinklers are available in either full-circle or part-circle models and most have an adjustable radius for watering irregular areas.

Proper Design is Important. The installation of an efficient sprinkler system begins with good design. The system must be capable of applying water uniformly over the desired area with a minimum of overspray into adjacent areas.

Choosing the appropriate sprinkler for a given area is important, but equally important is the location and spacing of sprinklers. It is usually desirable to place part-circle sprinklers along the boundaries of the irrigated area. This allows uniform watering along the edges while avoiding wasteful overspray onto buildings, paved areas, and other adjacent areas.

Proper spacing of sprinklers is crucial in achieving uniform water application. Sprinklers which do not overlap adequately will waste water by applying too much water in some areas and not enough water in others. On the other hand, spacing sprinklers closer than required increases the cost of the system and wastes water. In general, spacing between sprinklers should be about 50 percent of the wetted diameter. For example, sprinklers with a wetted diameter of 80 feet should be spaced 40 feet apart.

Where part-circle sprinklers are used on the same zone with full-circle sprinklers, the sprinklers should be carefully selected to achieve a "matched precipitation rate." A half-circle sprinkler will only water half as much area as a full-circle sprinkler, therefore it should only discharge half as much water. If a full-circle sprinkler discharges 6 gallons per minute, then a half-circle sprinkler should deliver 3 gallons per minute and a quarter-circle sprinkler 1 ½ gallons per minute. Most manufacturers offer sprinklers with matched precipitation rate (MPR) nozzles.

One other important aspect of proper design is pipe sizing. Selection of pipe sizes should be based on the flow rate through the pipe. If pipes are too small, excessive pressure losses occur. This causes some sprinklers to apply more water than others and results in non-uniform application and waste of water. Additional information on pipe sizing and irrigation system design is available in Georgia Cooperative Extension Bulletin 894, Irrigating Lawns and Gardens, http://www.caes.uga.edu/publications/ as well as design manuals available from the sprinkler manufacturers.

Check the Application Rate of Sprinkler Systems. Application rate is the rate at which a sprinkler system applies water to the soil surface, measured in inches per hour (in./hr.). If application rates exceed the intake capacity of the soil, run-off occurs. Problems with run-off are more likely to occur in clay soils which have a low intake capacity.

Rotary sprinklers usually have application rates of 0.25 to 0.50 inches per hour and rarely cause run-off. Spray heads, on the other hand, typically have application rates between 1 and 2 inches per hour and may cause run-off on heavy soils, especially where slopes are greater than 10 percent. If run-off occurs, turn off the system for an hour or two to let the water soak in. Then apply the remainder of the water.

Determine application rate of a sprinkler system by placing three or four rain gauges at random on an irrigated area for a predetermined length of time (usually one hour). By knowing the application rates of the sprinkler system, it can be determined how long to operate the system to apply a given amount of water. This will avoid wasting water. Average water level within the gauges is a measure of the output of the system (inches per hour). Repeat this procedure in each sprinkler zone, particularly if different types of sprinklers are used on different zones.

Use rain gauges to monitor the output of your sprinkler system.

Adjust Sprinkler Heads As Needed. Improper adjustment of sprinkler heads not only wastes water but also may cause accidents if the water is allowed to spray onto buildings, public streets, or sidewalks. Carefully adjust the radius and arc of part-circle sprinklers to prevent undesirable overspray. Check the system several times during the year to ensure proper adjustment.

Drip Irrigation. Drip irrigation, also called trickle or micro-irrigation, applies water slowly and directly to the roots of plants through small flexible pipes and flow control devices called emitters. Drip irrigation uses 30 to 50 percent less water than sprinkler irrigation and usually costs less to install. Apply water directly to the root zone to minimize evaporative water loss and run-off.

For maximum water-use efficiency, use drip irrigation on trees, shrubs, and flowers in the high and moderate water-use zones of the landscape. There are several types of drip irrigation systems which can be adapted to suit a variety of applications, from watering individual trees and shrubs to beds of annuals, herbaceous perennials, or ground covers.

Components of a Drip System.

In a drip system, water is distributed to the plants through small, flexible plastic pipes (3/8 to 3/4 inch in diameter) and emitters, or through perforated or porous pipe.

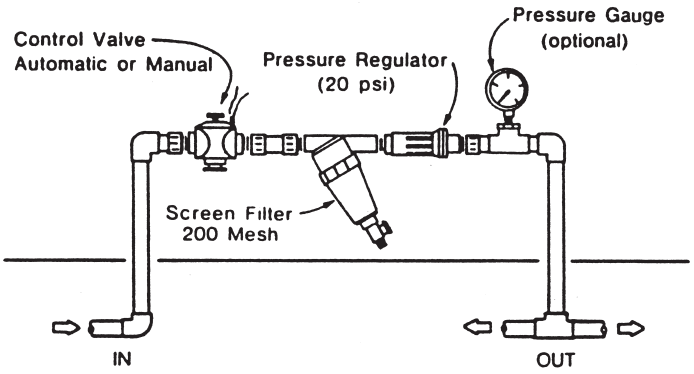


Figure 8. Typical controls required for drip irrigation. These components are usually installed below ground in a valve box.

Emitters may be purchased separately from the tubing and placed in the line wherever watering is desired. Another option is to purchase drip tubing with emitters already installed at the factory, usually spaced 12 to 24 inches apart. Most emitters will discharge water at a rate of ½, 1, or 2 gallons per hour at a pressure of about 20 pounds per square inch.

Perforated or porous pipe discharges water along its entire length to wet a continuous strip. By spacing the pipe 12 to 18 inches apart, it is possible to wet a solid area. It is a good system for closely spaced plantings of annuals, herbaceous perennials, or groundcovers.

Most drip systems will use PVC pipe for main lines and polyethylene tubing for distribution lines. Polyethylene tubing is flexible, easy to cut, and can be connected without glue or clamps. Install emitters by punching a hole in the polyethylene tubing and snapping the emitters into place.

The drip system must have a main valve to turn it on and off. It may be an automatic electric valve connected to a controller, or it can be a manual gate valve. Also, the drip lines may be connected directly to an outside faucet. However, when connecting the system directly to the faucet, use an automated timer to turn the system off after a preset time. Otherwise, it is possible to forget and leave the system on for several days.

Two other necessary components for a drip system are a filter and a pressure regulator. See Figure 8. A drip system uses small passageways to control the rate of water application so that even tiny particles suspended in the water could cause clogging problems. To prevent clogging, use a screen filter with a 150 to 200 mesh screen.

Most drip systems are designed to operate at a pressure of about 20 psi, (pounds per square inch). Household water pressure typically ranges from 40 to 100 psi. A pressure regulator installed immediately after the filter in the main line will reduce the pressure in the line and ensure efficient operation of the system.

Which Drip System is Best?

Since there are so many different types of drip irrigation components, trying to choose the best system for a particular application is often confusing. The best advice is to keep it as simple as possible, and try to wet only those areas where the water can be taken up by the roots of the desired plants.

For trees and shrubs it is generally best to use a system in which emitters can be inserted wherever water is needed. The number of emitters per plant and flow rate (gallons per hour) per emitter depend on the size and type of plant. Generally, the larger the plant, the more water it requires. Table 5 gives an example of how emitters might be installed based on plant size.

Table 5. Drip irrigation emitter selection based on plant size

Plant Height (ft.)	# Emitters per Plant
< 2	one - ½ gallon per hour
2 - 4	one - 1 gallon per hour
4 - 6	two - 1 gallon per hour
6 - 7	three - 1 gallon per hour
7 - 8	four - 1 gallon per hour two - 2 gallon per hour

During very dry weather, a drip system would need to run about three times per week for four hours to supply the optimum water needs of the plants. Keep in mind that some species require more water than others. Consider this when installing emitters.

For watering annuals, perennials, and ground covers, it is usually necessary to irrigate a solid area. This can be done using emitter lines with emitters spaced every 12 to 18 inches. By placing emitter lines 12 to 18 inches apart, a uniform wetting pattern can be achieved. Perforated or porous pipe spaced every 12 to 18 inches apart can also be used. In sandy soils the lines will need to be closer together than in tighter soils. In annual flower beds the drip lines can be laid aside during bed preparation and replaced afterwards.

Another method of watering that is similar to drip irrigation uses small sprinkler heads, called micro-sprinklers, instead of emitters. All other components are identical to drip irrigation, including the polyethylene distribution lines. Micro-sprinklers spray an area 3 to 12 feet wide and are

used for trees and shrubs or beds requiring complete coverage. Micro-sprinklers may be prone to vandalism and are not quite as efficient as emitters, but they do provide an economical method of achieving uniform watering.

In landscape applications, drip irrigation tubing is usually installed on top of the ground and concealed beneath mulch. This makes the system easy to install and service. However, if vandalism is likely, the tubing can also be installed 4 to 6 inches beneath the soil surface with small microtubing (1/8 to 1/4 inch) protruding to the surface. Running the microtubes above-ground will allow for easy inspection and will prevent dirt from back-siphoning into the emitters and clogging the system.

Guidelines for Irrigating the Landscape

Establish Irrigation Objectives. In a Water Smart landscape, the goal is to minimize the amount of supplemental water applied to the landscape. Therefore, routine irrigation is necessary only in the high water-use zones. Occasional hand watering or a portable irrigation system, such as porous pipe, would be used "as needed" in the moderate water-use zones. Established plants in low water-use zones would receive only natural rainfall and no supplemental irrigation water.

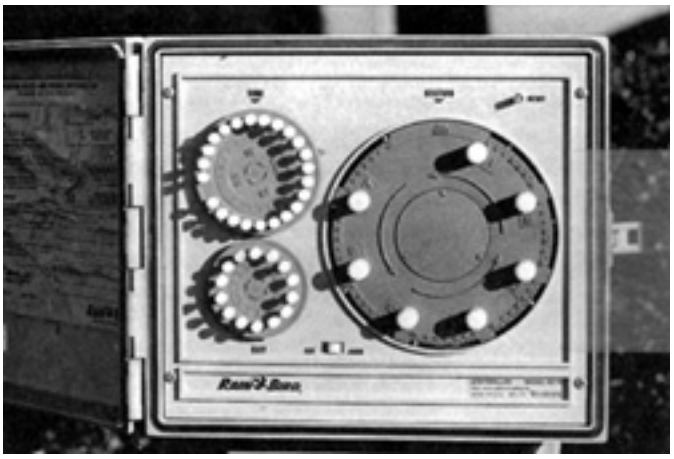
Operate Sprinklers between 9 P.M. and 9 A.M. Time of application affects water-use efficiency. The best time to irrigate with sprinklers is between 9 P.M. and 9 A.M. During this time there is generally less wind and lower temperatures and therefore less water lost to evaporation. Irrigating during the evening after dew develops (9 P.M.) and before it dries in the morning (9 A.M.) does not increase disease problems.

Drip irrigation systems can be operated any time of day because evaporative water loss is not a problem, and the foliage stays dry.

An Automatic Controller Helps Save Water. An automatic controller attached to the irrigation system turns the system on and off and controls the water flow through the various zones according to a pre-set time clock. It allows for setting the length of time each zone operates, days of the week the system operates, and time of day it operates.

However, an automatic controller does not eliminate the need to closely monitor its operation. Controllers should be re-programmed frequently during the growing season because water needs change from week to week.

A rainfall sensor attached to the controller detects rainfall and prevents the irrigation system from operating if significant rainfall has occurred. Another type of sensor measures soil moisture and overrides the system when soil moisture is adequate. Sensors are especially useful if the system cannot be monitored and adjusted regularly.



Use of an automatic controller can save water and labor.

There are many different types of controllers on the market. Make sure to get one with the features needed. When managed properly, an automatic controller can pay for itself in reduced water usage, cost, and labor.

Hand Watering

Hand watering is not just for newly-planted ornamental plants. It is also an effective and efficient way of applying water to selected plants that show signs of stress during dry periods. The direct application of water to the base of the plant, provided it is applied slowly enough to be absorbed by the soil, uses less water and is more efficient than sprinkler irrigation.

To avoid run-off when using the hand-held hose, use a nozzle that divides the spray into rain-size droplets. Some nozzles have built-in spray pattern adjustments.

When watering by hand, apply about 5 gallons of water per 10 square feet, which is approximately the amount of water delivered by a 5/8 inch garden hose operating one minute at medium pressure. Watering small shrubs (less than 4 feet in height) for one minute with the hand-held hose should suffice. Larger shrubs (4 feet and up) will require slightly more water. Increase the watering time by 15 seconds for each foot in height exceeding 4 feet. For large trees, apply about 6 or 7 gallons for each 10 square feet of canopy area. For best results, check the output of the faucet by determining the number of seconds to fill a one-gallon jug and then estimating output per 60 seconds.

Irrigating Turfgrass

Turfgrasses used in Georgia can survive seasonal dry periods without irrigation and therefore can be used in any water-use zone. In moderate water-use zones, a turfgrass would be irrigated only when it shows signs of moisture stress. Turf-

grass under water stress will appear a dull bluish green color, the leaf blades will roll inward and footprints will remain on the grass after walking over an area. Irrigating turfgrass in the moderate water-use zones with a portable lawn sprinkler, within 24 to 48 hours of these signs, will generally prevent serious loss of vigor while maximizing water-use efficiency.

Under optimum growing conditions (high water-use zone), turfgrasses use 1 to 1 ½ inches of water per week during hot dry weather. It is usually best to divide this amount into two applications per week applying 1/2 to 3/4 inch each time. Never apply more than one inch at a time as this will likely result in runoff or deep percolation below the root zone. Early or late in the season, when temperatures are cooler, it is usually adequate to irrigate only once per week.

Never water grass daily except during establishment. Daily irrigation with small amounts of water encourages a shallow root system and reduced drought tolerance as shown in Figure 9. Since roots generally grow where the soil is moist, a shallow root system also prevents efficient uptake of plant nutrients. Shallow, frequent irrigation increases evaporative water loss from the soil.

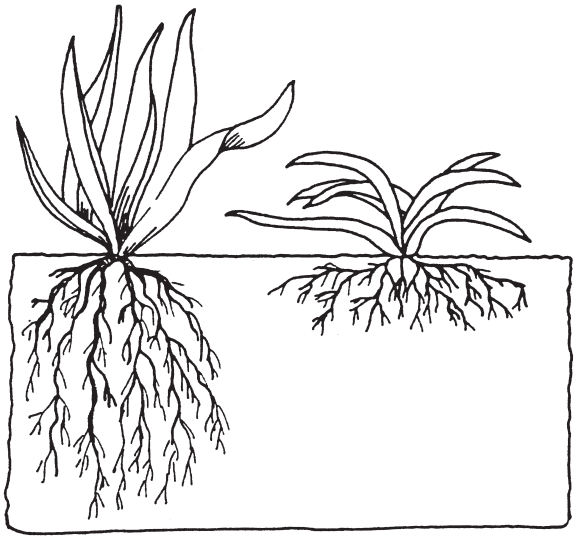


Figure 9. The healthy, deep-rooted grass on the left is the result of proper irrigation. The weak, shallow-rooted grass on the right results from light, frequent irrigation.

Irrigating Trees and Shrubs

Woody ornamental trees and shrubs have a deeper, more extensive root system than turfgrasses or herbaceous ornamental plants. The root system of a mature tree, for instance, extends two to three times the canopy spread and may go down several feet into the soil. Woody plants, therefore, can extract moisture from the soil, even when the soil surface appears bone dry, and can survive long dry periods without supplemental irrigation.

Use drip irrigation on trees and shrubs in the high water-use zones of the landscape. Locate the emitters near the drip line of plants where the concentration of absorbing roots is the highest. During extended dry periods, operate the system two to three times per week. Run the system long enough to thoroughly wet the soil 18 to 24 inches deep.

Regular and thorough watering of newly-planted trees and shrubs will encourage good root establishment and greater drought resistance.

Irrigating Herbaceous Ornamentals (Annuals and Perennials)

Herbaceous ornamentals vary widely in their tolerance to drought. Some will perform adequately with a minimum of supplemental water, while others require close attention to soil moisture. Irrigation can be provided most efficiently if the plants within a bed have similar water needs.

Herbaceous ornamentals generally have a more shallow root system than woody ornamentals and are among the first plants in the landscape to show water stress during dry periods. Water these plants once or twice a week and use drip irrigation whenever possible. If unable to irrigate because of restrictions, remember that these plants are less costly to replace than trees and shrubs.

STEP 6: Use of Mulches

Mulching is one of the most beneficial landscape practices. Mulches conserve moisture by preventing evaporative water loss from the soil surface and reducing the need for supplemental irrigation during periods of limited rainfall. By maintaining an even moisture supply in the soil, mulches prevent fluctuations in soil moisture that can damage roots (see Figure 10).

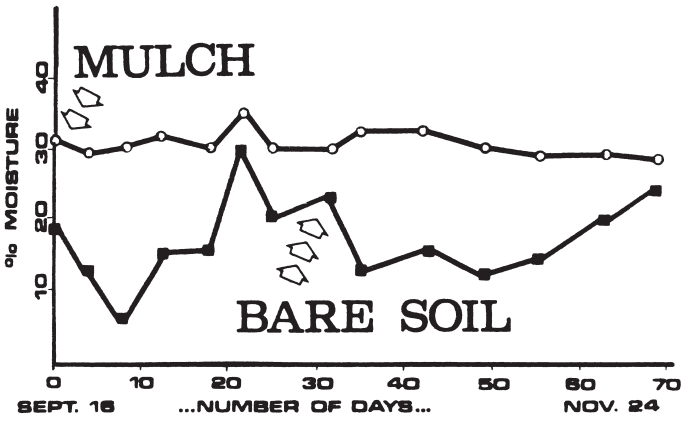


Figure 10. Moisture level of mulched vs. bare soil

Mulches also prevent crusting of the soil surface and allow water to penetrate readily to plant roots. They insulate the roots of plants from summer heat and winter cold and help control weeds that compete with plants for moisture. By serving as a barrier between the plant and soil, mulches help discourage soil-borne diseases that stress plants and cause them to have a higher demand for water.

Islands of unplanted organic mulch, designed to blend with the landscape, are an economical way to retrofit an existing landscape to make it more water efficient while reducing maintenance requirements. Aside from occasional weed control and topdressing with additional mulch, unplanted mulched areas require no water and little routine maintenance.

Islands of natural organic mulch to blend with the landscape are an economical way of conserving water while reducing maintenance.

Pine straw, pine-bark mini-nuggets, and shredded hardwood mulch or chips are some of the best mulches for a Water Smart landscape. These fine-textured mulches hold moisture in the soil better than coarse-textured mulches, such as large-nugget pine bark. They also are non-matting and allow water, nutrients and oxygen to freely move into the soil.

Inorganic mulches, on the other hand, such as rock, gravel, and marble, absorb and re-radiate heat from the sun and increase water loss from plants and soil.

Apply approximately 3 inches of mulch under ornamental plants in the landscape. Avoid applying too much mulch because it encourages shallow roots which are easily damaged by excessive cold, heat, or drought.

Where possible, extend the mulched area two to three times the canopy spread of ornamental trees and shrubs. Research shows that the roots of ornamental plants grow far beyond the canopy spread so it is important to mulch as large an area as practical.

Once mulch is in place, pull it back, 2 to 3 inches, from the trunk of trees and shrubs. This will help prevent-wood rotting diseases.

During periods of limited rainfall, make certain sufficient mulch is maintained beneath plants. If watering restrictions prevent irrigating, mulches will help conserve the moisture remaining in the soil.

Newspapers, 2 sheets thick, placed under organic mulches at planting time, is another water conservation practice. They also may be used on established ornamentals by carefully removing the organic mulch from around the plants, placing the newspapers two sheets thick on the soil surface and reapplying the mulch. Be certain to wet the newspapers thoroughly, immediately after application; otherwise, they may pull moisture from the soil. Also, avoid placing more than 2 layers of newspaper on the surface because it may impede water and nutrient movement into the soil.

STEP 7: Appropriate Maintenance

By following the six previous steps toward water conservation in the landscape, a beautiful landscape can be developed that not only saves water and money, but also requires minimal maintenance.

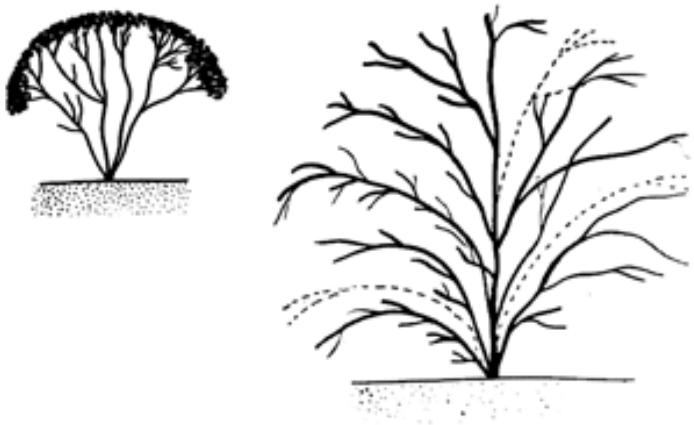
The objective of Water Smart maintenance is to discourage water-demanding new growth on plants. In other words, keep plants healthy but do not encourage optimum growth at all times. Depending on the current level of maintenance, it may be possible to fertilize less often with less fertilizer, to prune less frequently, and to irrigate less often. Remember, a Water Smart landscape is a low-maintenance landscape. By working smarter, not harder in the landscape, it is possible to save time, energy, and water without sacrificing the beauty of the environment.

Fertilize Less and Use Slow-release Fertilizers. When purchasing a fertilizer, look closely at its contents. Nitrogen, the first number in the analysis, is the element that promotes new growth. Purchase a fertilizer having nitrogen in a slow-release form, such as sulfur-coated urea, urea formaldehyde, or IBDU (isobutylenediurea). Some new products on the market feed plants for an entire growing season with one application. Slow-release type fertilizers generally cost more than all-purpose garden fertilizers, such as 8-8-8 or 10-10-10, but they last longer by releasing nutrients gradually. Also, they do not leach from the soil or wash away in run-off as readily as all-purpose fertilizers.

Always check the application rate on the label. The label usually suggests an application rate for optimum growth. This application rate is ideal for newly-planted ornamental plants and turfgrasses to encourage healthy new growth and plant establishment. However, once plants are established, the recommended application rate of fertilizer can be reduced without sacrificing quality or appearance. This reduction in application rate is particularly important prior to, or during, dry periods.

Leaving grass clippings on turfgrass at each mowing, a process called "grasscycling", supplies the grass with recycled nutrients and reduces the need for supplemental fertilizer. Grasscycling does not promote thatch (a spongy condition of the turf). Thatch results from a build-up of grass stems, shoots, and roots, not clippings. As much as one-third of the nutrients applied to the lawn can be recycled back to the grass through grasscycling.

Avoid Shearing Plants. Just like nitrogen fertilizer, shearing promotes water-demanding new growth on plants. When pruning is required, use hand shears or loppers to thin branches and twigs to a side branch or bud. Thinning results in a more open, natural canopy and is less stressful to the plant than shearing.



Thinning (right) is better than shearing (left).

Proper Mowing Saves Water. Proper mowing practices are of particular importance in Water Smart landscapes. Mow at the recommended height (Table 6), and mow often enough so that no more than one-third of the leaf tissue is removed at each mowing. For example, if tall fescue is to be maintained at a height of 2 inches, then it should be cut when it reaches 3 inches. Research shows that raising the mower blade during dry weather and cutting the grass higher encourages deeper rooting, increases turf survival during drought and reduces water demand. Mow turfgrass in shaded areas higher than turfgrass in full sun. Avoid scalping and stressing the grass, and make certain the mower blade is sharp at all time.

Table 6. Mowing heights for turfgrasses in Georgia

Turfgrass	Inches
Centipedegrass	1 to 2
Common bermudagrass	1 to 2
Hybrid bermudagrass	0.5 to 1.5
St. Augustinegrass	2 to 3
Zoysiagrass	0.5 to 2

Aerating Turfgrass Improves Water Movement. Aeration, or coring of turfgrass areas, is sometimes required to relieve soil compaction and to increase air and water movement into the soil. It is particularly helpful on slopes where water run-off is possible, and in areas of heavy foot traffic where compaction has occurred. Aeration is best accomplished with a power aerator which has hollow tines that remove small cores of soil. Many rental stores have this type of equipment available. Aeration is best during periods of active plant growth, and when the soil is moist enough to allow deep penetration of the tines. Generally, aeration is used to correct soil problems and is not done on a routine basis.

Other Water-Saving Maintenance Practices

Do Not Let Weeds Compete with Plants for Water. Scout the landscape regularly and do not let weeds take over. Hand-weeding, chemical herbicides, and mulches will help keep weeds in check.

Scout for Pests Before Spraying. While scouting for weeds, also scout for insect and disease pests. Control pests when they begin affecting the appearance and overall health of a plant. Target control measures to the affected plants and avoid spraying the entire landscape if the pest problem is confined only to a small area.

Make Every Drop Count. Where irrigation systems are used, check nozzles and emitters regularly to see if they are operating efficiently, and if they are delivering the right amount of water in the right locations.

Watch for Water Stress Symptoms. Learn to identify the symptoms shown by plants under water stress. Shrubs under moisture stress will turn a grey-green color and wilt. Trees will show premature fall color and shed leaves early. Turfgrasses will turn a dull grey-green color and the blades will wilt and roll inward.

Survival Watering During Drought or Watering Restrictions. During drought or watering restrictions, consider the replacement cost of the plants in the landscape and do what is possible to save the most valuable plants. Annual flowers can be replaced more readily than trees and shrubs. If you are unable to water, cut back annual flowers and mulch them heavily to help them survive a drought.

If you are allowed to water, selectively hand-water shrubs and trees that show drought stress first. Although trees have an extensive "bank account" of roots to absorb water during dry periods, prolonged drought can severely stress and damage a large portion of their surface roots. A thorough watering of three small areas (60 gallons/100 square feet near the dripline), each two weeks in clay soils and once a week in sandy soils, using the hand-held hose, will minimize tree damage during an extended dry period.

If there is a total ban on watering and some plants begin to wilt badly or defoliate, consider pruning their canopies by one-third to one-half. This will reduce water demand on the roots and will increase their chances of survival during drought.

Gray Water, defined as waste water discharged from residential lavatories, bathtubs, showers, clothes washers, and laundry trays, can be used in Georgia to water outdoor plants. Bill 463 passed by the Georgia Senate in 2008, provides the following guidelines and requirements:

Private residential direct reuse of gray water shall be lawful if the following conditions are met:

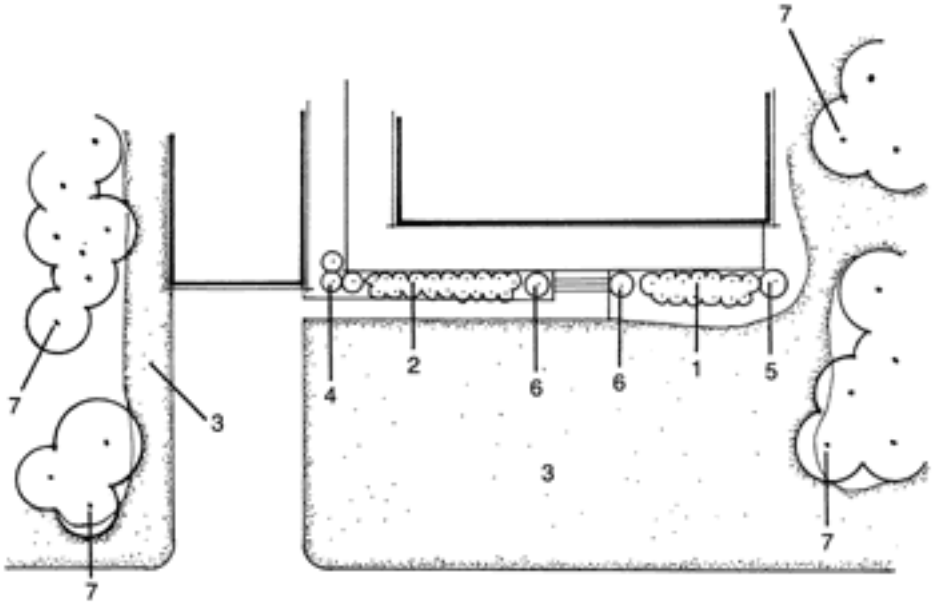
1. Gray water originating from the residence shall be used and contained within the property boundary for household gardening, composting, lawn watering, or landscape irrigation;
2. Gray water shall not be used for irrigation of food plants;
3. The gray water shall not contain hazardous chemicals derived from activities such as cleaning car parts, washing greasy or oily rags, or disposing of waste solutions from home photo labs or similar hobbyist or home occupational activities;
4. The application of gray water shall be managed to minimize standing water on the surface;
5. The application of gray water shall be outside of a floodway;
6. The gray water shall not contain water used to wash diapers or similarly soiled or infectious garments unless the gray water is disinfected before irrigation; and
7. The gray water shall be applied only by hand watering using garden watering cans or similar hand-held containers.

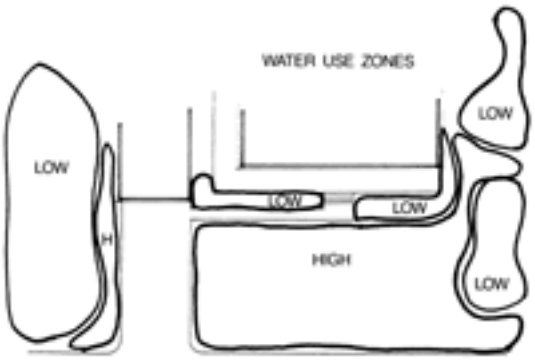
In Georgia, water from gray water systems installed as part of a plumbing system cannot be used for irrigating landscapes. Harvested rainwater can be used for irrigation and has no restrictions.

Commercially Designed Water Smart Landscapes: Before and After Renovation

The landscape designs that follow show before and after plans of actual landscapes renovated for water conservation. In some cases, there has been a change in the water-use zone even thought the type of turfgrass was not changed. This is because the owner adjusted his water management practices.

Before:

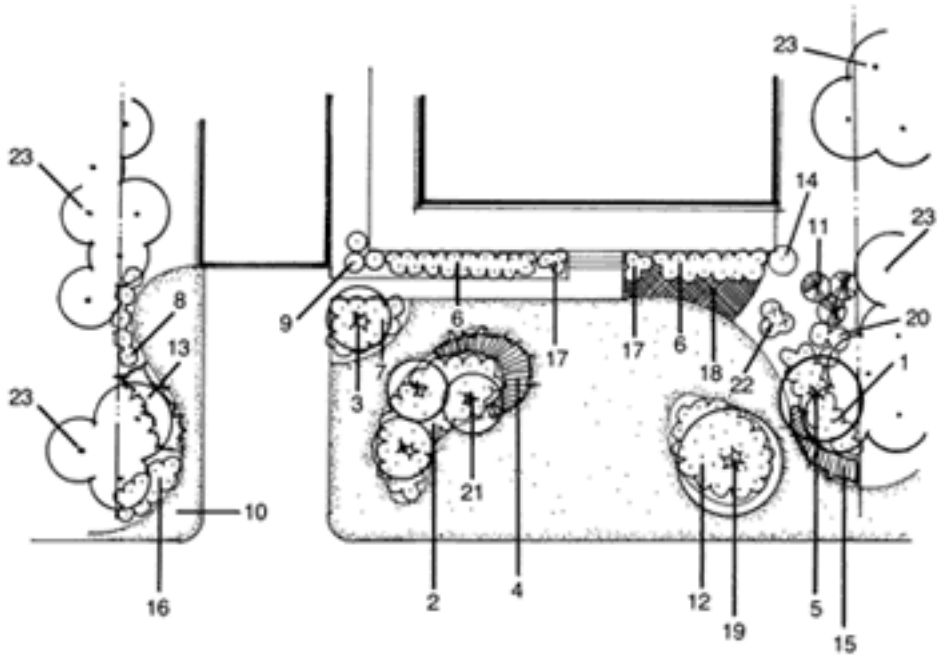


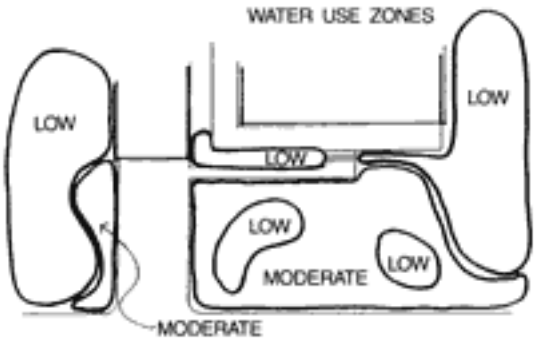


Plant List:

1. Burford Holly
2. Dwarf Yaupon Holly
3. Fescue Turf
4. Foster Holly
5. Leyland Cypress
6. Variegated Privet
7. Trees (existing)

After:



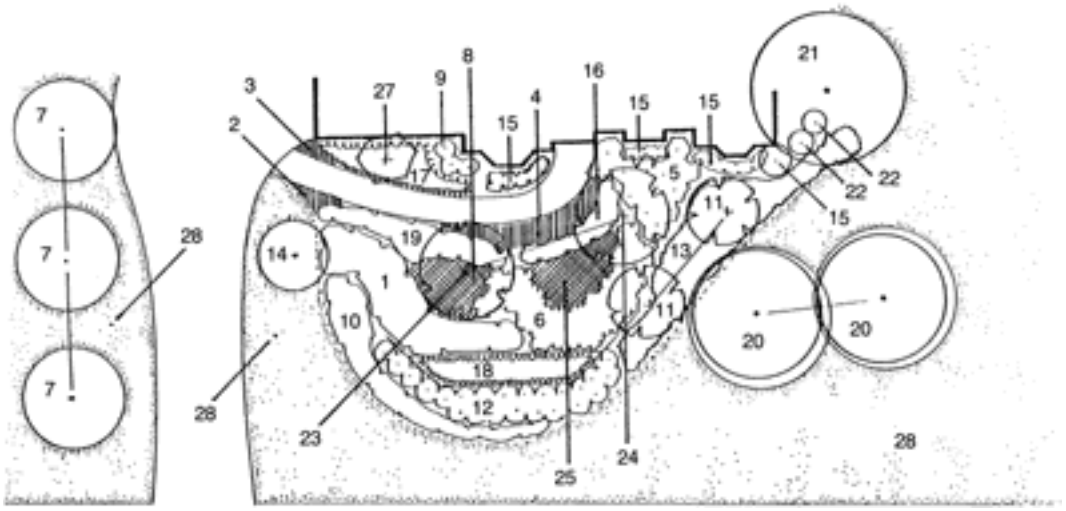


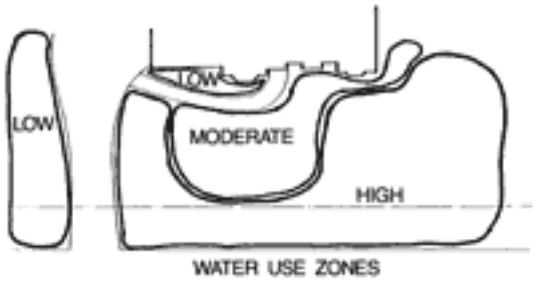
Plant List

1. Azalea
2. Carissa Holly
3. Crape Myrtle
4. Daylilly
5. Dogwood
6. Dwarf Yaupon Holly
7. Dwarf Yaupon Holly
8. Forsythia
9. Foster Holly
10. Hybrid Bermuda Turf
11. Japanese Black Pine
12. Juniper, Sargents
13. Juniper, Blue Pacific
14. Leyland Cypress
15. Liriope
16. Nandina
17. Otto Luyken Laurel
18. Perrinnials and Herbs
19. Pin Oak
20. Quinch
21. River Birch
22. Variegated Privet
23. Trees (existing)

Credit: *Design Courtesy of Allgood Outdoors, Alpharetta, GA; Strickland Residence; Designer - Jacob Zimmerman*

Before:

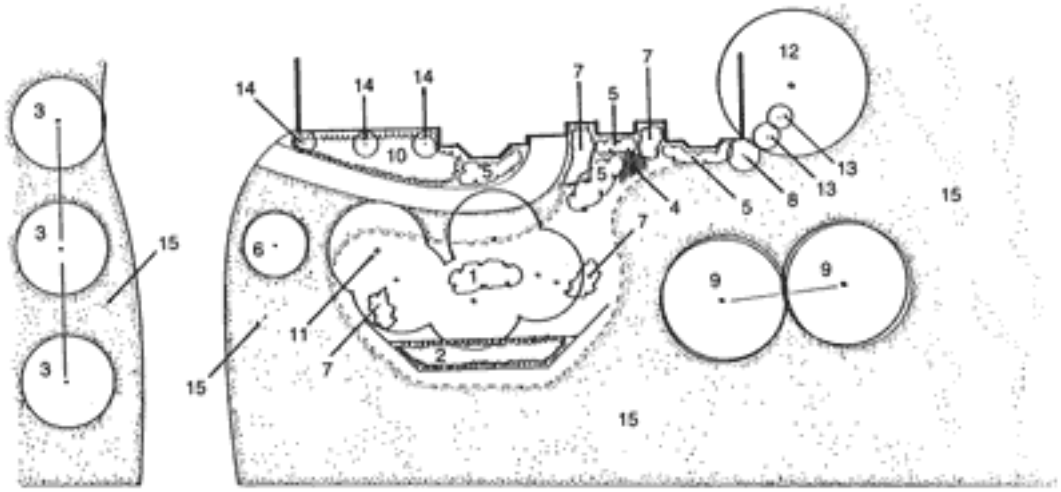


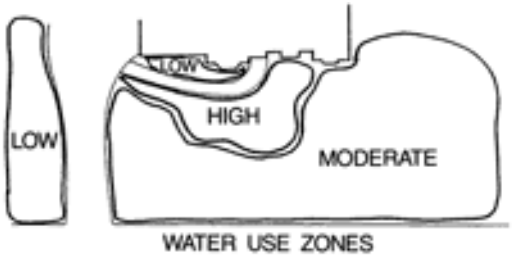


Plant List

1. Azalea
2. Blue Pacific Juniper
3. Bradford Pear
4. Chrysanthemums
5. Compacta Holly
6. Flowering Cherry
7. Hosta
8. Nellie R. Stevens Holly
9. Oaks
10. Parsons Juniper
11. Pines
12. Poplar
13. Variegated Privet
14. Waxleaf Ligustrum
15. Turf (fescue)

After:



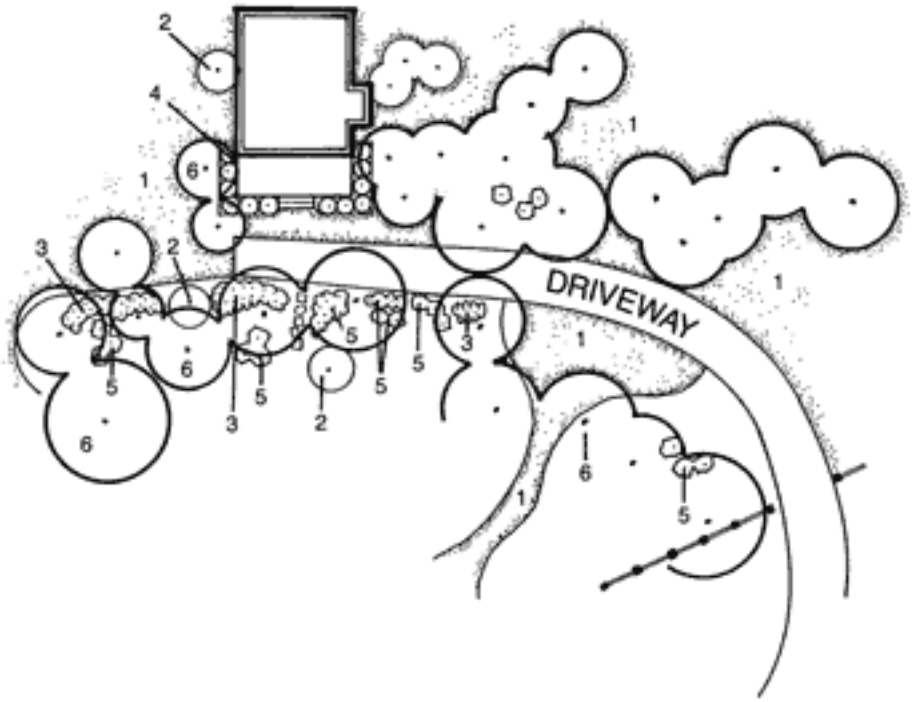


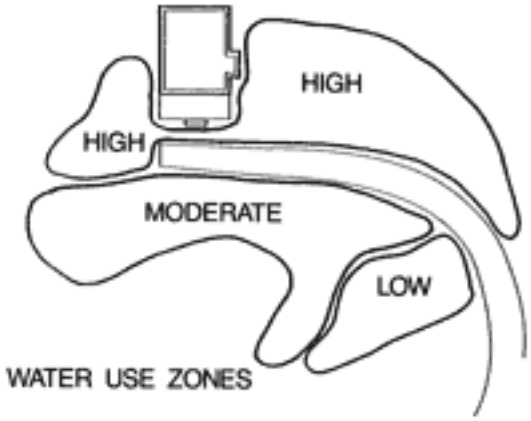
Plant List

1. Abelia, Sherwood
2. Annuals
3. Annuals
4. Annuals
5. Azalea, G.G. Gerbing
6. Azalea, G. Tabor
7. Bradford Pear
8. Christmas Fern
9. Cleyera
10. Daylilly, Aztec Gold
11. Dogwood
12. Dwarf Yaupon Holly
13. English Ivy
14. Flowering Cherry
15. Holly
16. Hosta
17. Juniper
18. Juniper
19. Liriope, Green
20. Pak
21. Poplar
22. Privet
23. Redbud
24. Redbud
25. Southern Shield Fern
26. Wax Myrtle
27. Yaupon Holly
28. Turf (fescue)

Credit: *Design Courtesy of Bregenzer's, Inc., Alpharetta, GA; Pilkington Residence; Designer - Randolph Beck*

Before:

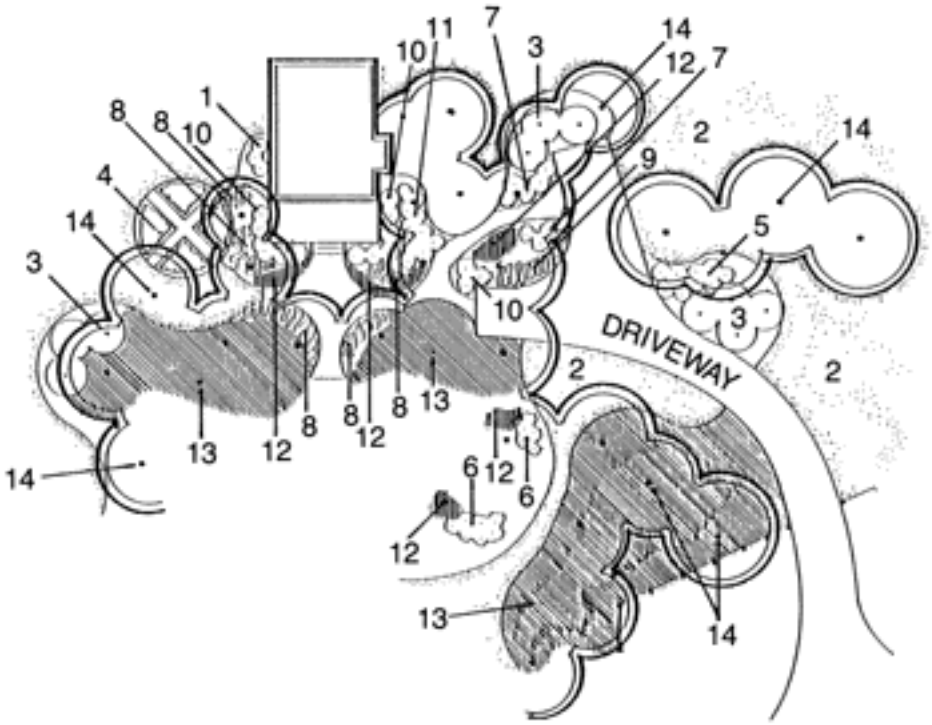


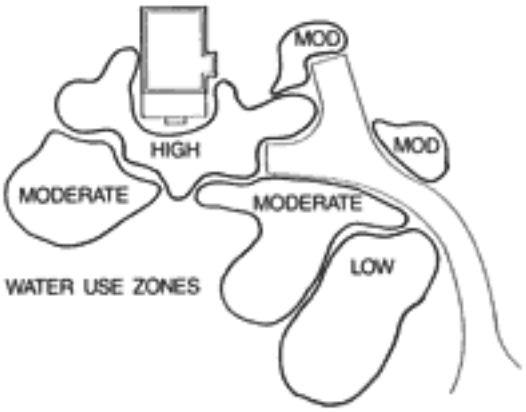


Plant List

1. Tuft (fescue)
2. Hemlock
3. Perennials
4. Rhododendron
5. Shrubs (assorted)
6. Trees (native)

After:



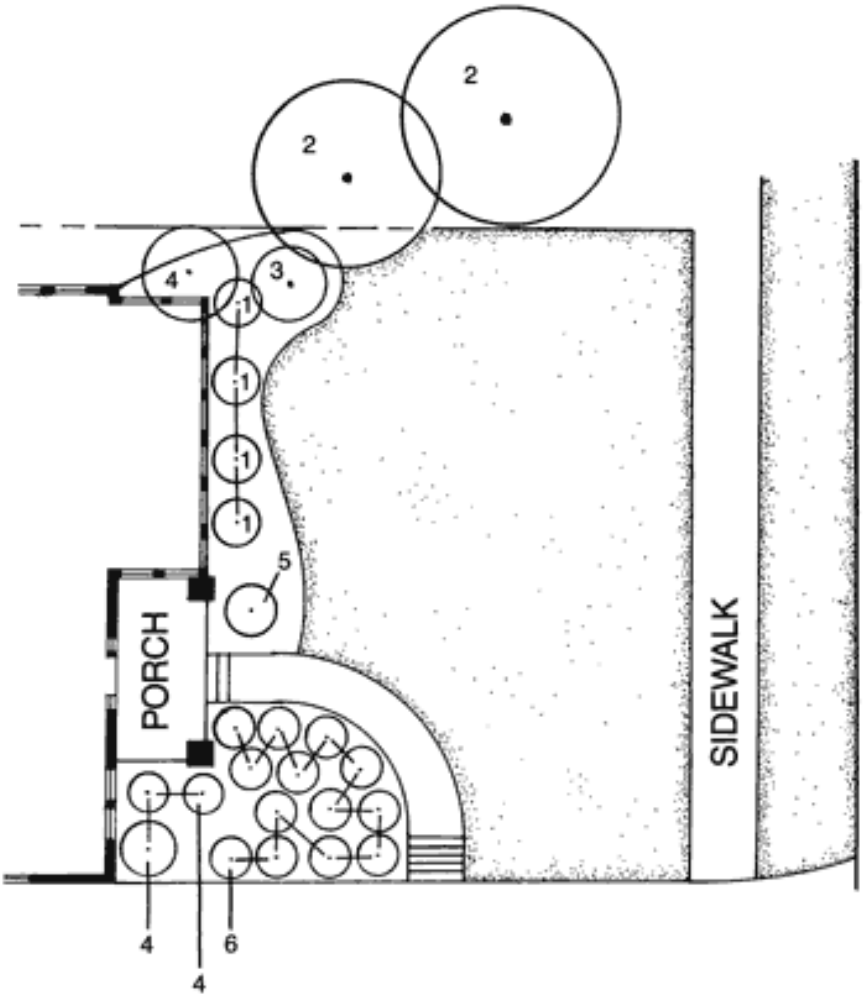


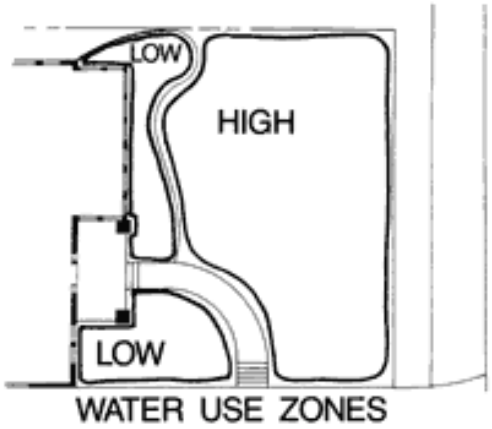
Plant List

1. Anise
2. Turf (fescue)
3. Hemlock
4. Herb Garden
5. Indica Azalea
6. Leucothoe
7. Mountain Laurel
8. Perennials
9. Phlox
10. Rhododendron
11. Satsuki Azalea
12. Seasonal Color
13. Vinca Minor
14. Trees (native)

Credit: *Design Courtesy of Lifescapes, Inc., Canton, GA; Sewell Guest Cabin; Designer - Pat Noe*

Before:

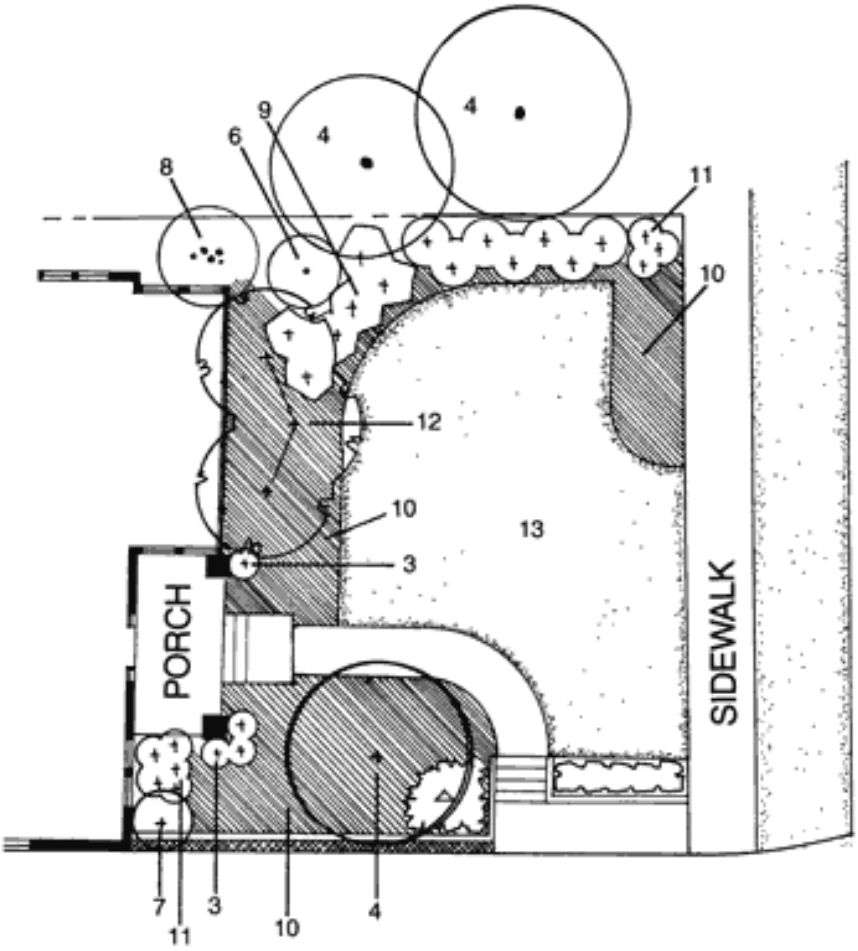


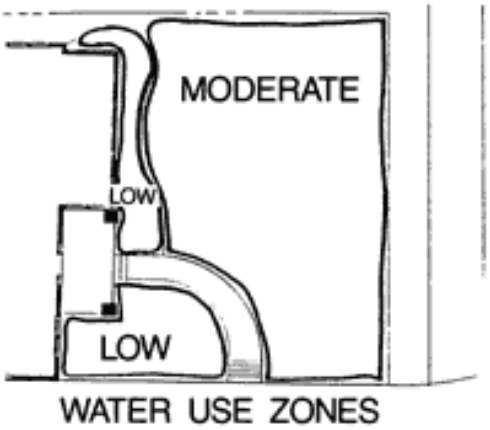


Plant List:

1. Boxwood
2. Dogwood
3. Eleagnus
4. Holly
5. Nandina
6. Pfitzer Juniper

After:





WATER USE ZONES

Plant List

1. Azalea, G. Tabor
2. Azaleas, Gumpo
3. Boxwood, American
4. Dogwood
5. Dogwood (existing)
6. Eleagnus (existing)
7. Foster Holly
8. Holly (existing)
9. Hydrangea, Bigleaf
10. Mondo Grass
11. Otto Luyken Laurel
12. Yaupon Holly (tree form)
13. Turf (zoysia)

Credit: *Design Courtesy of William T. Smith & Associates, Atlanta, GA; Redd-Chezmar Residence; Designer - William T. Smith*

Summary

Water used on the outdoor landscape is considered non-essential water use, compared to water used for cooking, bathing, cleaning and other life essentials. Therefore, when restrictions are placed on domestic water use (water supplied to citizens by local governments or private utilities), non-essential uses of water are the first to be curtailed. As urban areas continue to grow and develop and increasing demand is placed on municipal water systems, restrictions on water use are likely to become common, even during periods of normal rainfall.

By implementing the seven steps to a Water Smart landscape described in this publication, it is possible to reduce outdoor irrigation by as much as 50 percent without sacrificing the quality or beauty of the home environment.

Remember..., the landscape alone does not save water...it is up to us to save water. Considerable water savings can be realized simply by breaking bad watering habits and learning how to water, when to water, the most efficient ways to water, and the water needs of southern ornamental plants.

By putting the Water Smart practices to work in your landscape, you are not only being a good steward of the environment but also are preserving and protecting the resources on our planet and helping assure our children and future generations the same quality of life that we have grown to appreciate.

Acknowledgement

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Director of County Operations, CAES (retired)
Neal Weatherly Jr.,
UGA College of Environment and Design

Additional Reading

http://www.caes.uga.edu/publications/

Best Management Practices for Landscape Water Conservations, Bulletin 1329
BMP in the Landscape, Circular 871

Making Every Drop Count Series:

Efficient Landscape Irrigation Systems, Circular 895-5
Managing a Water-Wise Landscape, Circular 895-4
Proper Planting Results in Healthy, Water-Efficient Plants, Circular 895-3
Water Saving Tips when Planting a New Landscape, Circular 895-2
Xeriscape: Seven Steps to a Water-Wise Landscape, Circular 895-1

Learning for Life

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