

## Background & Perspective:

Watering urban plant vegetation may result in a 3-fold increase in domestic water use during the summer months (Kjelgren et al., 2000; White et al., 2004).

San Antonio is a recognized leader in water conservation via the San Antonio Water System (SAWS) Conservation Program.

San Antonio passed a 2006 Water Conservation Ordinance with an impact on turfgrass.

## Provisions:

Turfgrass associated with new construction after January 1, 2006

Minimum soil depth of 4-inches beneath the turfgrass

Turfgrass established after January 1, 2007, shall have

summer dormancy capabilities. “Summer dormancy”

defined as the ability of turfgrass to survive without

water for a period of sixty consecutive days between

months of May through September.

Beginning January 1, 2007 SAWS will maintain a list

of turfgrasses that have demonstrated summer

dormancy capabilities.

# turfgrass drought tolerance...

Set at 60-day recovery period for survival following a 60-day drought.

The 60-day periods were arbitrary and not an industry standard!

5 commercially available turfgrasses

Cultivars in the San Antonio market

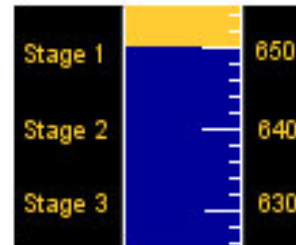
Native soil depth - a newly established site

Root barrier at a depth of 4-inches.

# Restrictions

Watering with an irrigation system or sprinkler is allowed only once a week before 10 a.m. or after 8 p.m. on your designated watering day as determined by your address:

[HOME](#): [CONSERVATION](#) : [DROUGHT RESTRICTIONS](#)



## STAGE 1

**Stage One Restrictions** begin when the [aquifer level](#) drops to 650 feet mean sea level at the monitored well.

- **Water waste is prohibited at all times.** Water waste includes allowing water to run off into a gutter, ditch, or drain; or failing to repair a controllable leak.
- **You should reduce water consumption** by any means available.
- **All non-public swimming pools** must have a minimum of 25 percent of the surface area covered with evaporation screens when not in use. Inflatable pool toys or floating decorations may be used.
- **Hand watering** with a hand-held hose, soaker hose, drip irrigation, bucket or watering can is permitted any time and any day.
- **Washing impervious cover** such as parking lots, driveways, streets or sidewalks is prohibited. Health and safety exceptions to this rule may be requested from SAWS in writing.
- **Residential washing of vehicles** or other equipment is allowed only on assigned watering

### Fall Watering

Drought or no drought, landscape needs vary this time of year. [Learn more](#)

### Landscape Watering

Watering with an irrigation system or sprinkler is allowed only once a week before 10 a.m. or after 8 p.m. on your designated watering day as determined by your address:

### Last Digit of Street Address

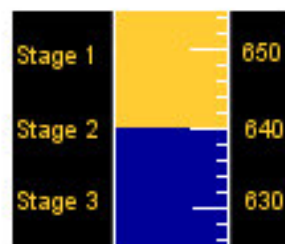
0 or 1

2 or 3

4 or 5

# Restrictions

Watering with an irrigation system or sprinkler, permitted only once a week on designated watering day during hours of 3 a.m. to 8 p.m. and 8 p.m. to 10 p.m.:



## STAGE 2

**Stage Two Alert** begins when the Aquifer level reaches **640** feet mean sea level at the well.

- All restrictions from [Stage 1](#).
- Aesthetic fountains prohibited, unless treated wastewater is used.
- Watering with a hand-held hose or drip irrigation permitted during the hours of 3 a.m. to 8 p.m. and 8 p.m. to 10 p.m. any day.
- Watering with an irrigation system or sprinkler, permitted only once a week on designated watering day during the hours of 3 a.m. to 8 a.m. and 8 p.m. to 10 p.m.:

Last Digit of Address	Day
0 or 1	Monday
2 or 3	Tuesday
4 or 5	Wednesday
6 or 7	Thursday
8 or 9	Friday

- Filling of new and existing swimming pools is prohibited unless at least 30% of the water is obtained from a source other than the Edwards Aquifer. In addition, refilling is prohibited if it has been drained for repairs.
- Conforming golf courses shall effect a 20% reduction of ET rate. Non-conforming golf courses shall use no more than 1.6 times their base usage. Accompanied by reduced ET rate.
- Athletic fields shall reduce water use by an additional 5% from Stage 1 and have a plan with SAWS an approved conservation plan.

# Restrictions

ation with a soaker hose,  
-end sprinkler or in-  
nd irrigation system

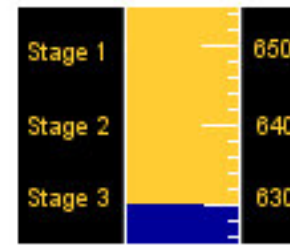
wed every other week  
nning on the second  
day after the Stage III  
been declared

a.m. to 8:00 a.m. and  
p.m. to 10:00 p.m.

dheld hose, drip  
ation system or 5 gallon  
et Tuesdays, Thursdays,  
rdays during Stage III

s.

[HOME](#): [CONSERVATION](#) : [DROUGHT RESTRICTIONS](#)



## STAGE III

**Stage Three Alert** begins when the Aquifer level reaches **630** feet mean sea level at a well.

- All restrictions from [Stage 2](#).
- Aesthetic fountains prohibited, unless treated wastewater is used.
- Irrigation with a soaker hose, hose-end sprinkler or in-ground irrigation system every other week beginning on the second Monday after the Stage III has been declared from 8:00 a.m. to 8:00 a.m. and 8:00 p.m. to 10:00 p.m. Handheld hose, drip irrigation system or 5 gallon bucket Tuesdays, Thursdays, Saturdays during Stage III hours.
- Watering newly planted landscapes permitted only with a variance from the State Water Conservation Department.
- Conforming golf courses shall effect a 10% reduction of ET rate. Non-conforming shall use no more than 1.8 times their base usage.
- Athletic fields shall reduce water use by an additional 5% from Stage 1 and have a SAWS an approved conservation plan.
- Non-commercial washing of vehicles is permitted only on the assigned residential watering day & times. Use of a commercial vehicle wash facility is permitted.
- Water runoff onto streets is prohibited.

Last Digit of Address	Day
0 or 1	Monday
2 or 3	Tuesday
4 or 5	Wednesday
6 or 7	Thursday



about “Smart” conservation & Knowing about how much needed

Producing a “healthy grass” that can persist on the least amount of irrigation water

Knowing how to water your lawn efficiently for the good of your lawn

Keeping applied water on your landscape

plants are nearly **80% water** by weight!

plants use **water** to take up soil nutrients

plants cool themselves by moving water out through tiny pores in the leaves (a process called **transpiration**)

**transpiration cooling** is essential for the overall growth and maintenance of turfgrass.

Water is lost through **transpiration** is greater under "summer-like conditions" high temperature, high wind, windy with low humidity.

Water is also lost from **soil reservoir** by "evaporation" from soil surfaces.

**Evapotranspiration (ET)** is a term that describes the combined water loss from the turf soil system.





# “Water Wise”

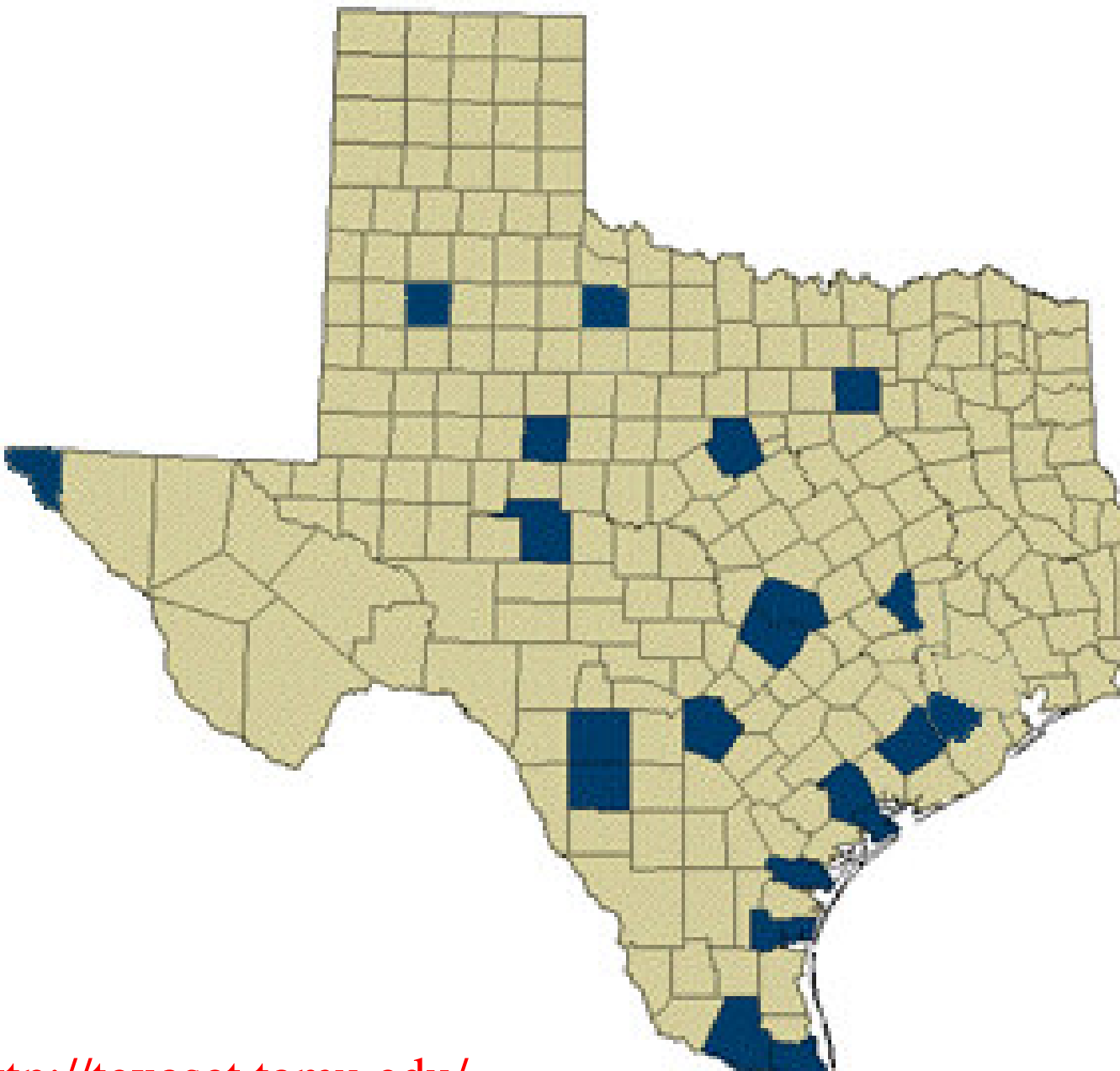
Potential Evapotranspiration (PET) are estimated by weather station throughout Texas. See the PET site at: <http://texaset.tamu.edu/> estimates the maximum amount of water lost from the soil (transpiration) and grass plant (respiration) numbers are reported in inches of water lost per day per week or month is also commonly estimated.

Weather Station



More on PET and how it can help to know how

ano  
Farms  
nd  
town  
r  
k  
Cristo  
brales  
gelo  
tonio  
ur Aquifer  
Golf Course  
Center



<http://texaset.tamu.edu/>

potential Evapotranspiration,  $ETo$  (also abbreviated as PET), is an estimate of the water requirements of a 4-inch grass growing in topsoil under well-watered conditions. A turf coefficient ( $Tc$ ) is used to relate  $pET$  to the water requirements of a specific turf. For established lawns, the  $Tc$  remains constant throughout the active growing season of the grass. For warm season grasses, such as bermudagrass, the  $Tc$  is 0.6 throughout much of the year, while the  $Tc$  for cool season grasses, such as rye, is 0.8.

However, we seldomly apply this amount of water to lawns. We do not want maximum production of grass clippings. Instead, we want to maintain a healthy, attractive turf with as little water as possible. Thus, we modify the coefficient by specifying a Quality Factor.

The complete equation is:  $ETo \times Tc \times Qf = \text{turf water requirement}$

## **Turf Coefficient Values (Tc)**

Warm Season	0.6
Cool Season	0.8

## **Allowable Stress Values (AS)**

No Stress	1.0
Low Stress	0.8
Normal Stress	0.6
High Stress	0.5
Very High Stress	0.4



# Water Stress

Signs of water stress - called **wilt** will likely appear in local areas

**Spot-watered** without watering the whole lawn

Water stressed grasses usually show visual signs of wilt  
leaf rolling

Loss of turgor pressure in the plant causes wilting. When  
grass “wilts” footprints in the turf do not “spring” back

Water stressed or wilted areas turn color from green to a  
bluish/purplish color to “off” color brown patches.

**IMPORTANT:** Lawn grasses, can withstand periods of water stress without permanent damage to the plant.

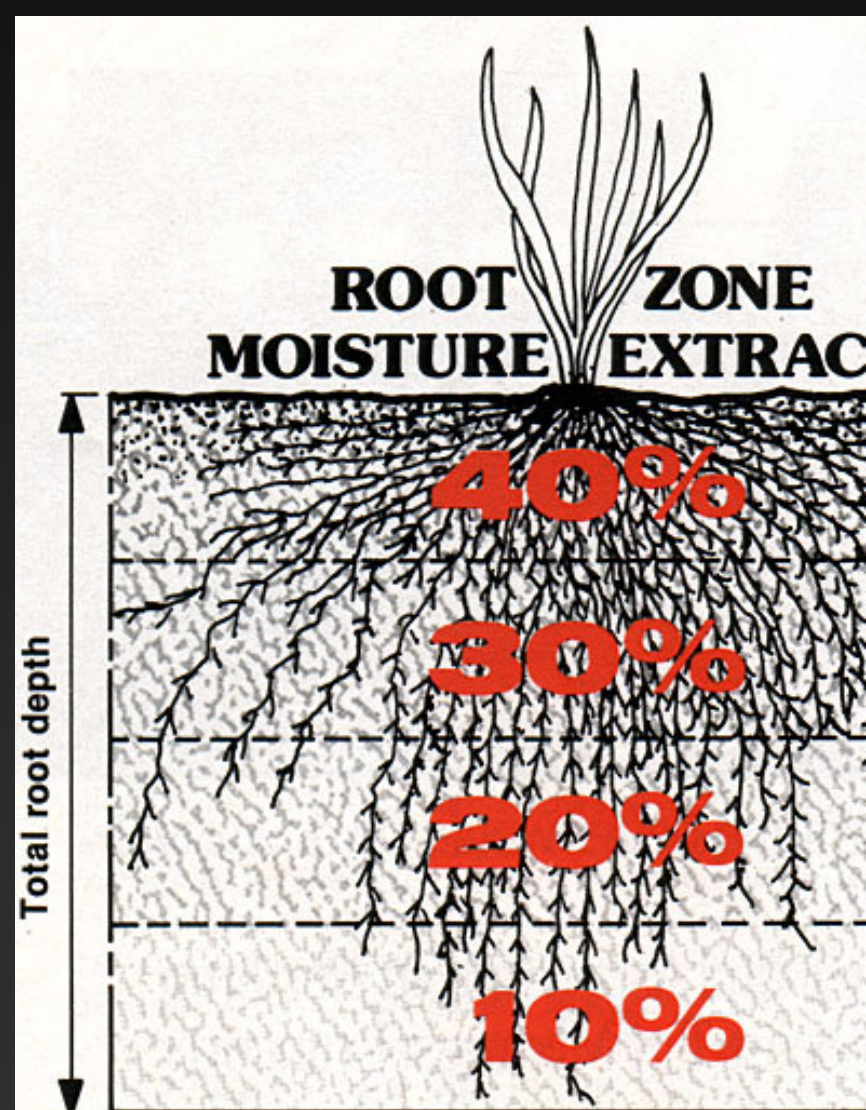
roots and the soil holds water for the roots!  
How water affects grass root growth and function

Roots initiate growth from the crown.

Roots function best when the soil is healthy and the soil has air in its pore spaces

Most of the roots are usually in the upper 1/2 of the total root system depth - see figure to

poor drainage or compacted soil can reduce root growth and



The root extraction pattern shows the percentage of moisture that the plant withdraws from each layer of the total root depth. This pattern is typical, regardless of soil depth. Deep-rooted plants require less frequent watering than shallow-rooted plants because the roots

# Water Deeply

Want water to reach 6 to 8 inches into soil

Deep Watering

- Deeper roots

- Plants more resistant to stress

Short applications

- Shallow roots

- Plants not resistant to stress



ed to apply and how we pay for water!

pay for water in gallons (per gal water used)

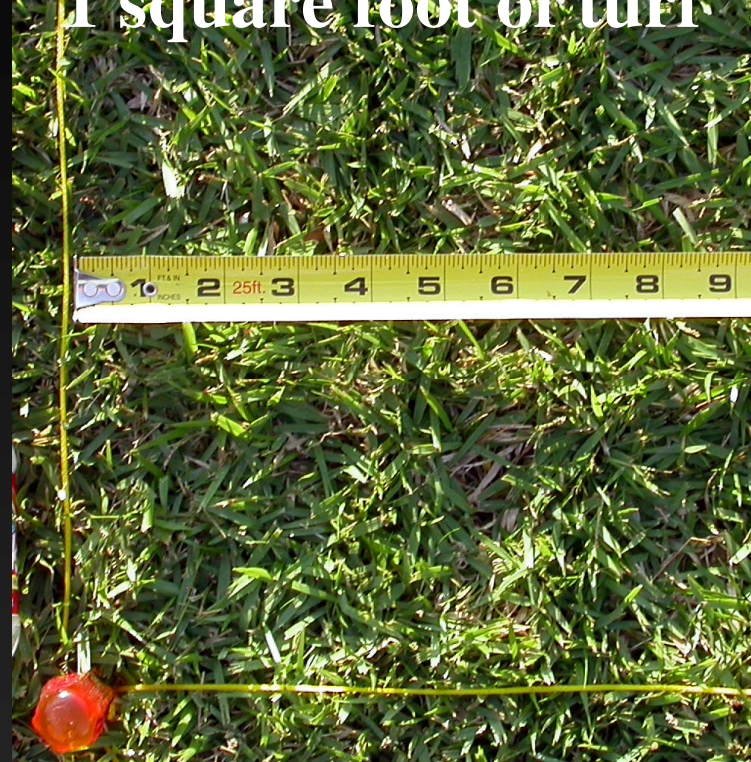
is a reference of plant use and oration - it is measured in inches.

is a term that is linked to urements of inches of water as a ence point for healthy plant th.

inch of water over 1 acre equals 154 gallons

0.62 Gallon/ft<sup>2</sup>

2 times 128 ounces = 79.3 ounce



esting:

gation controllers are  
cally set to water  
es for a period of time  
mber of minutes).

e watered rarely link  
k to gallons watered!

challenge is to  
erstand the linkages  
hese terms!



# How Much Water is Applied Over Time

uses “Catch Cans” to measure water applied over time in inches!

Checks the uniformity of water distribution for each sprinkler head.

Determines an irrigation system's application rate for each zone.

Helps understand irrigation system weaknesses and strengths and the need for



# Amount of water varies with lawn size.

Landscape size (square feet)	Water/sq. ft./inch (gallons/sq. ft.)	Total Water (gallons) @ PET	Total Water (gal) @ .6
500	0.6	310	
1,000	0.6	620	372
2,000	0.6	1240	
3,000	0.6	1860	
4,000	0.6	2480	
5,000	0.6	3100	1860
6,000	0.6	3720	
7,000	0.6	4340	
8,000	0.6	4960	
9,000	0.6	5580	
10,000	0.6	6200	3720

# How much water does my lawn need

**Typically during the summer 1.0" per week, applied in two applications works well.**

**Spring and Fall will require much less depending on rainfall.**

**Winter, probably not at all.**

The best time to water is in the early morning (4:00 am)

wind is low, water pressure is highest, consumer demand is low, evaporation rates are low.

**Watering in the evening**

places water droplets on the leaves for extended periods of time, which enhances disease.

**Water as deeply and infrequently as possible!**

If possible, water to a depth of 6 to 8 inches into the soil.

You may have to use additional cycles on the irrigation system to achieve this so as to avoid runoff.

Use a soil probe or screwdriver to check your watering.

# system puts out?

Place several small straight sided cans in the lawn and run the system for 15 minutes. Then measure and record the depth of water in each can and determine the average depth. Multiply the depth by 4. Then you will know the rate of application.

You must do this for all zones!

# Cont.

Example: you place 5 cans in the lawn and run a  
one for 15 minutes, you get the following depths

$$.25''(1/4''), .3, .20, .25, .25 = 1.25''$$

$$1.25 / 5 = .25''$$

You collected  $1/4''$  ( $.25''$ ) in 15 minutes.

$.25 * 4 = 1.0''$  per hour is your application rate!



# How much water does my lawn need?

## Cont.

Another simpler option would be to place a can on the lawn and run the system until you catch 1" of water! Then you will know how long it takes to apply 1" of water.

**where I live the soils are mostly clay, I  
put out 1" of water on the lawn, most  
it runs off! What can I do?**

**Set your controller to run multiple short cycles  
with at least 1 hour between run times, that will  
add up to the amount you want to apply. This  
way you can apply the desired amount of water  
without losses to run off.**

**Where I live the soils are shallow, if  
I put out 1" of water on the lawn, most  
of it runs off! What can I do?**

**In shallow soils you can apply only a limited  
amount of water, before the soil reaches field  
capacity, after that point water will move either  
down through cracks in the bed rock or laterally off  
the site. You will have to water more frequently  
with smaller volumes.**