University of California
Agriculture and Natural Resources

Water Management During Drought

UCCE Statewide Drought Workshop Series
Ventura County, September 14, 2015

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Maintaining An Existing Landscape

Hopefully Plants Were Selected Based on the Local Climate Zone

Sunset Zones for Ventura County: 20-24

Irrigation Scheduling Involves Applying the Right Amount of Water at the Right Time

What Factors are Involved in Irrigation Scheduling?

- Plant water use
- Soil water holding capacity
- Water infiltration rate
- Plant rooting depth
- Irrigation system output

Plant Water Use

- Varies Among Species
- Influenced By Microclimate
- Varies By Density

ET (Landscape Species) = ETo (Reference Evapotranspiration) x Kc (Crop Coefficient)

Reference Evapotranspiration (ETo)

- ETo = The Amount Of Water Used by a Large Uniform Planting of a Cool-season Grass Growing 3-6 Inches Tall Given Unlimited Water.

Factors That Determine ETo:

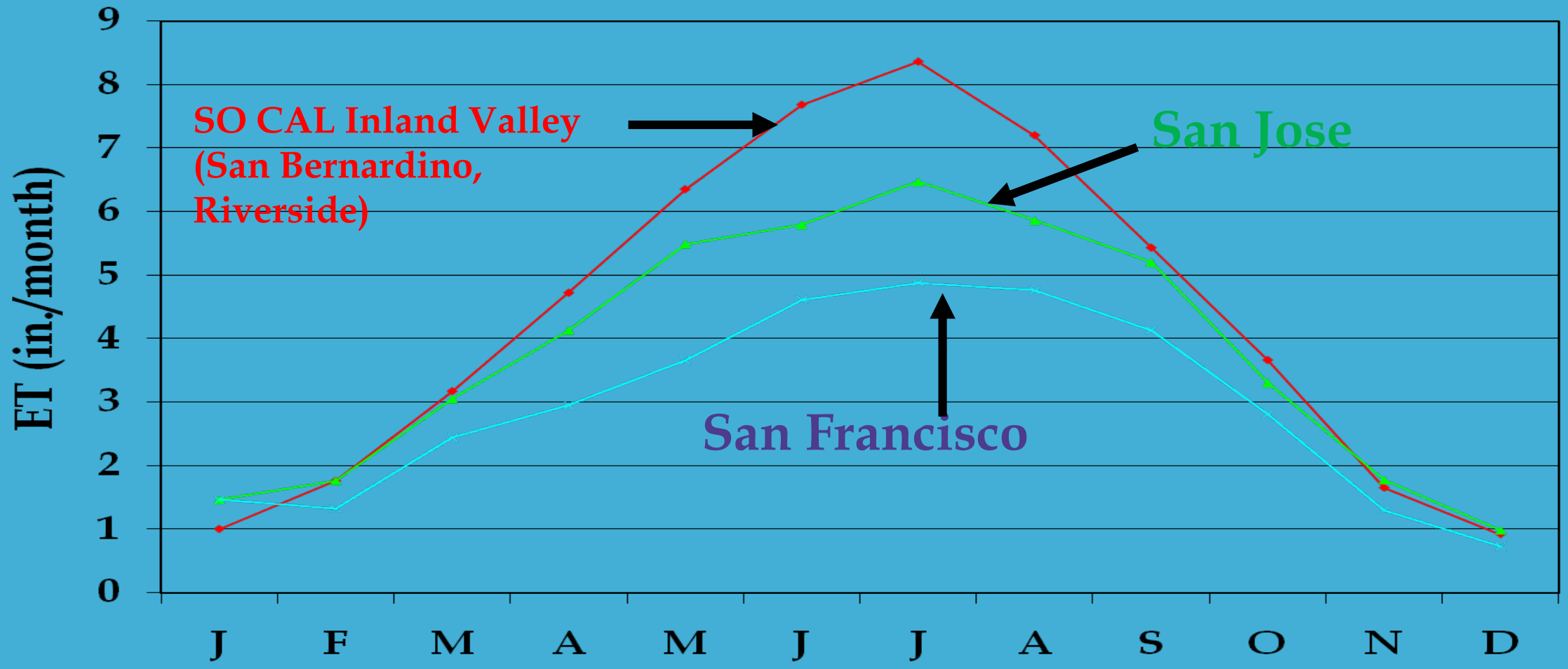
- Solar Radiation
- Temperature
- Wind Speed
- Relative Humidity

www.cimis.water.ca.gov

The California Irrigation Management Information System (CIMIS) measures these factors on an ongoing basis at over 100 stations throughout California

CIMIS Station

Average (Mean) ETo

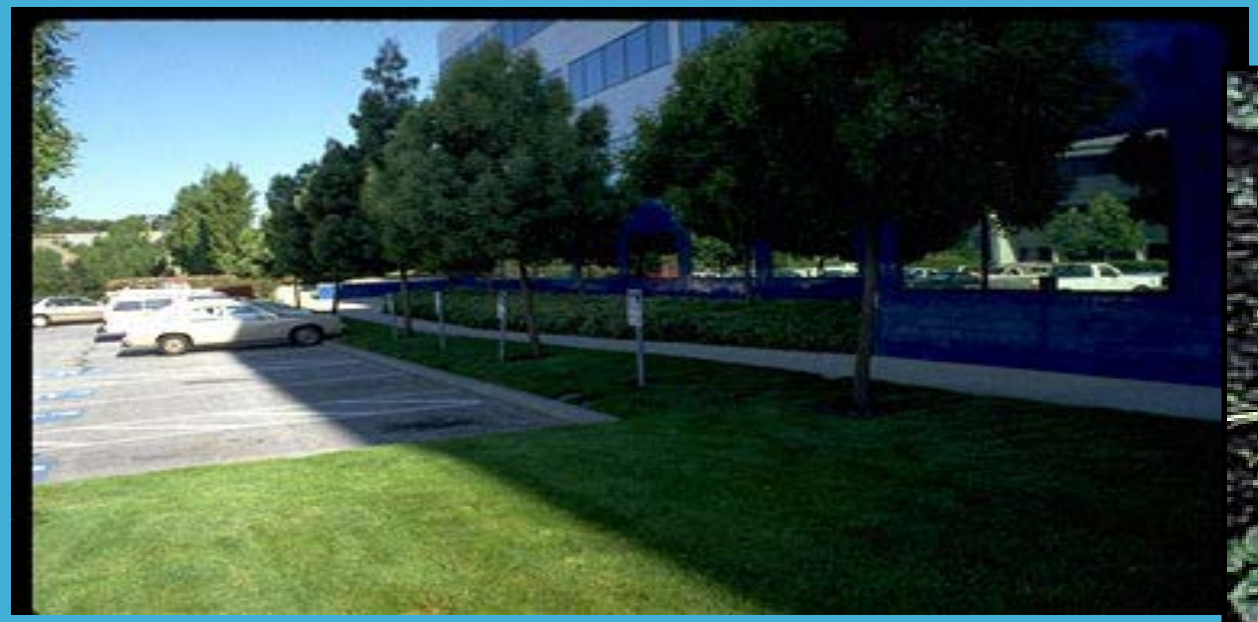


Plant ET Often Higher Than Actual Water Required For Acceptable Performance (Mesquite And Ficus)

Water Needs of the Same Species Vary Depending on Microclimate

- Landscape Plants in Heat Islands Require up to 50% More Water Than the Same Species in a Park Setting

Shade Vs Full Sun



Hydrozone: Plant Species With Similar Water Needs Together

Lawns And Groundcovers More ‘Crop-like’ Than Mixed Species With Varying Densities And Microclimates

Kc (Warm Season Turf) = .6

Kc (Cool Season Turf) = .8

‘Crop’ Of Turf

UC ANR's ***Lawn Watering Guide*** Based On Warm Season Grass Kc = .6 And Cool Season Grass Kc = .8 and a Distribution Uniformity Of 80%

http://ucanr.org/freepubs/docs/8044.pdf

How To Use The ‘Lawn Watering Guide’

- Determine Type Of Lawn (Warm vs. Cool Season Turf)
- Conduct A ‘Can Test’ To Determine Sprinkler System Output And Distribution Uniformity
- Determine How Long To Irrigate (Minutes Per Week) Based On Climatic Chart Provided
- Determine Maximum Amount Of Time To Water Per Event Until Runoff Just Begins

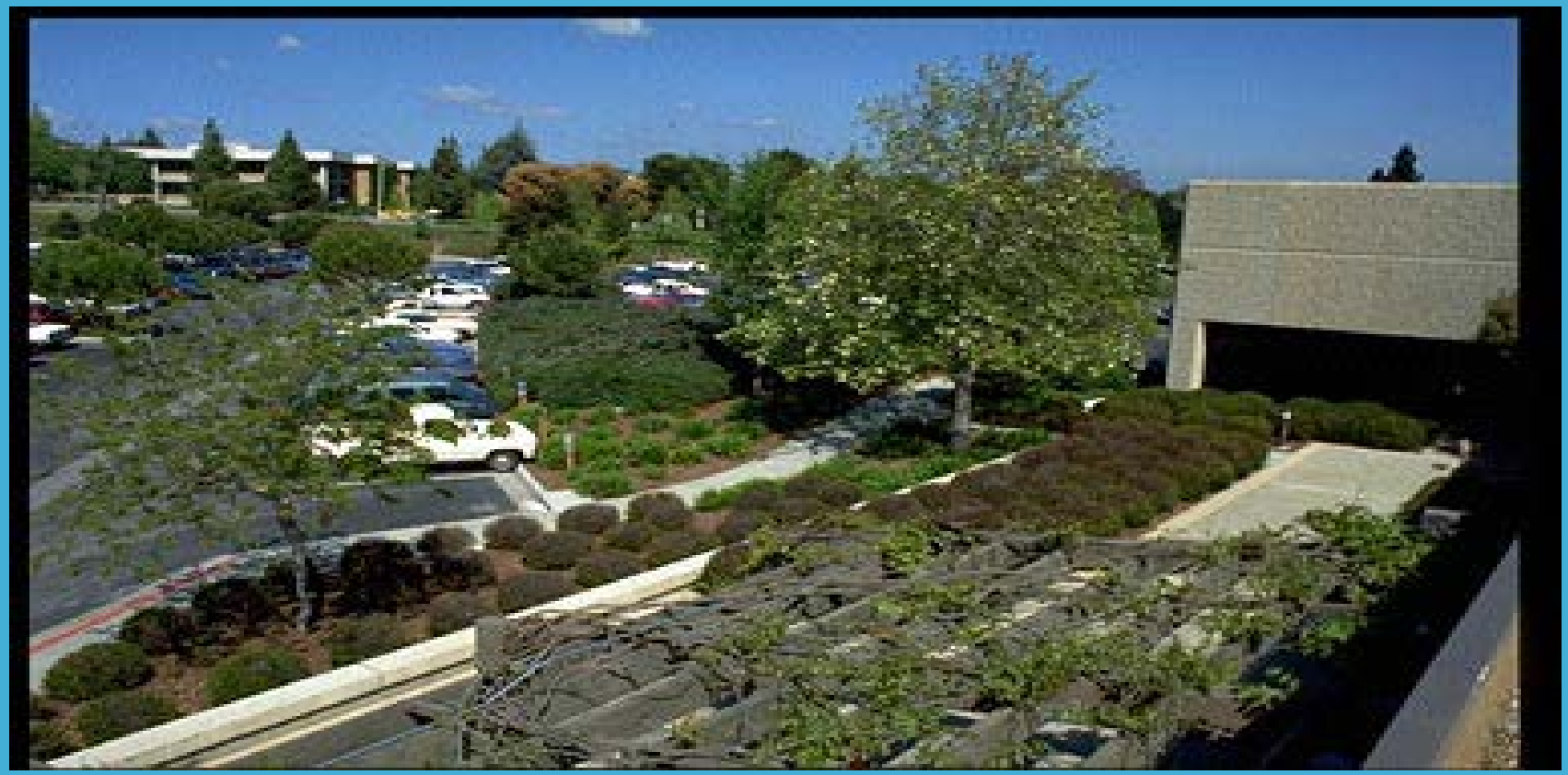
Identify And Repair Leaks, Low Heads, Broken Sprinklers, Unmatched Sprinklers And Pressure And Spacing Problems

Improve Distribution Uniformity to Improve Turf and Groundcover Health and to Reduce Water Waste

Good (top) and Poor (bottom) Distribution Uniformity

Water Cycling May Be Necessary to Avoid Run-off. Divide the Total Amount of Water Required Per Day into 2-4 Cycles. Apply Water as Close to Initial Event as Possible Before Soil Dries Out.

Planting Density Affects Water Requirement



Multi-tiered Canopy Uses More Water Than Single Tier Canopy

Low Density Planting

STATE WATER BUDGET LAWS
(Allows for only 70% of ETo and is being reduced to 55% ETo in Dec. 2015 for new and refurbished landscapes)

*MAWA = (ETo) (0.7) (LA) (0.62)

ETo = Reference Evapotranspiration (cool season turf): inches per year

0.7 = ET Adjustment Factor

LA = Landscaped Area (Square Feet)

0.62 = Conversion Factor (To Gallons)

***Maximum Applied Water Allowance = _____ Gallons/Year**

Example of Maximum Applied Water Allowance (MAWA)

- Inland Ventura/Santa Barbara Counties (Annual Historical ETo = 46.3 In)
- Hypothetical Landscape Area = 5,000 Sq Ft
- MAWA = (Eto) (0.7)* (LA) (0.62)**
- MAWA = (51.1) (0.7) (5,000 Sq Ft) (0.62)
- **MAWA = 100,471 Gallons Per Year**

*Et Adjustment Factor

** Conversion Factor From Inches To Gallons

External Resources for Plant Water Use Lists

(additional tools to combine with your own local knowledge as Master Gardeners)

- Sunset Garden Collection http://sunsetwesterngardencollection.com/

- California Native Plant Society: http://www.cnps.org/cnps/grownative/lists.php

- Local Water Districts

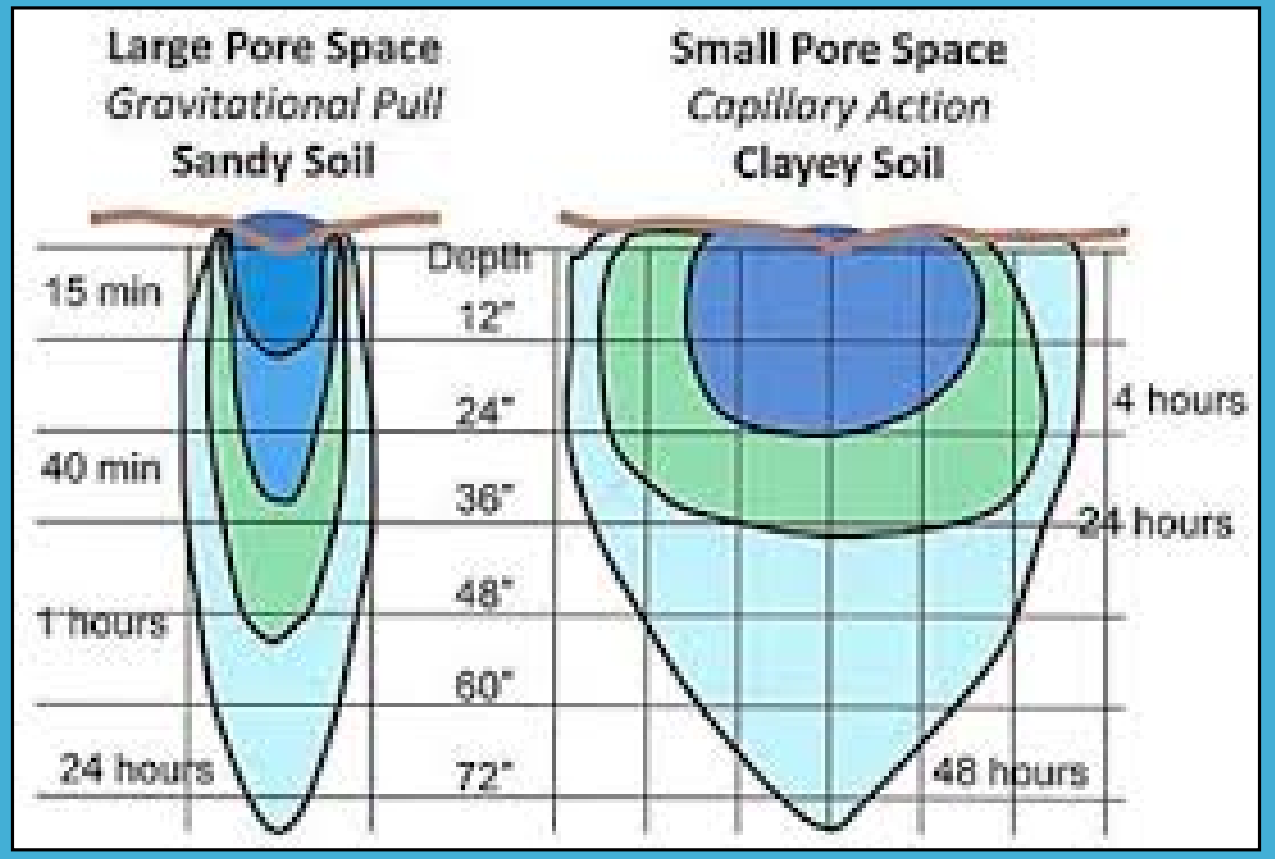
- WUCOLS IV (Water Use Classification of Landscape Species): http://ucanr.edu/sites/WUCOLS

Protected Tree Ordinances May Prohibit Cutting, Removing, Moving, Or Encroaching Upon Protected Indigenous Trees:

- California Live Oak
- Valley Oak
- Mesa Oak
- Scrub Oak
- California Sycamore
- California Bay

Determining When to Irrigate is as Important as Knowing How Much Water to Apply

Determine Soil Water Holding Capacity



Use the ‘Feel’ Test

Dry

Medium

Wet

Depths to Irrigate

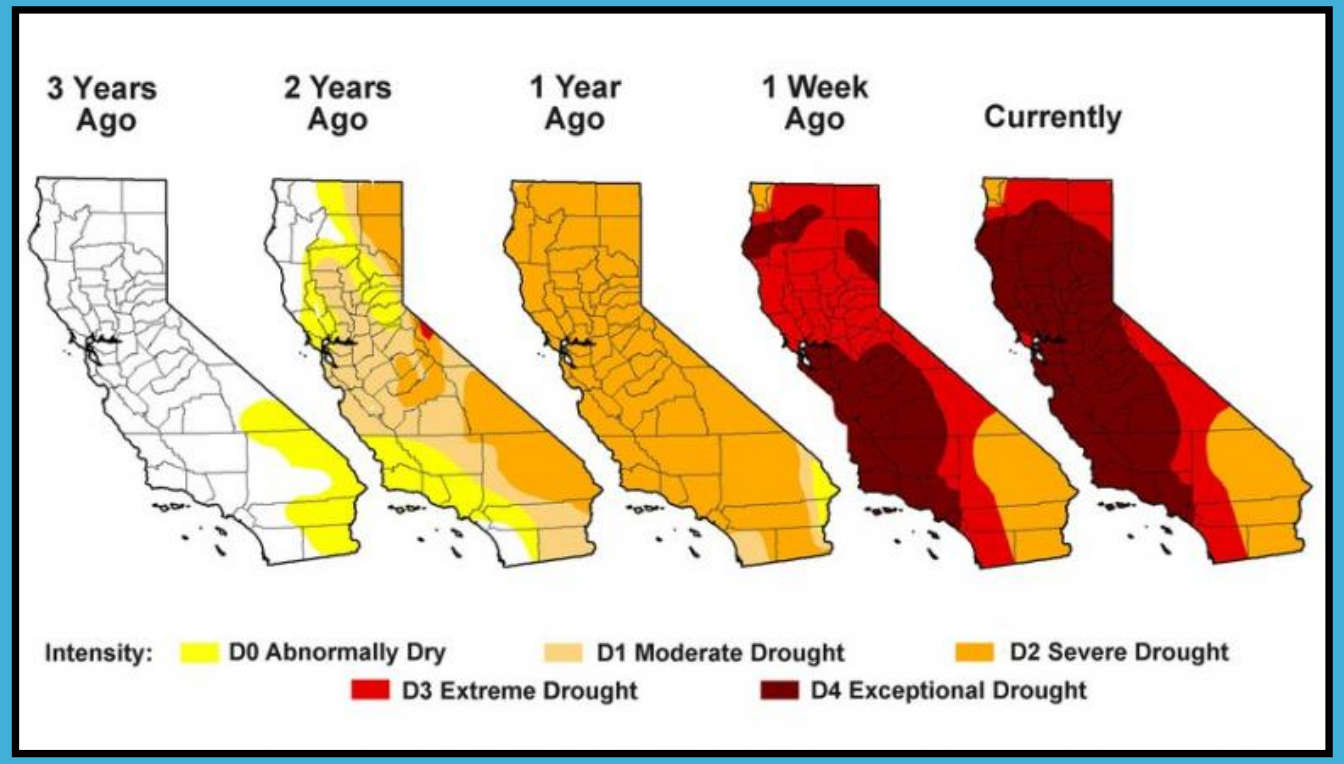
Turf	- 8 To 12 In.
Shrubs	- Small: 1 Ft.
	- Large: 2 Ft.
Trees	- Small: 2 Ft.
	- Large: 3 Ft.

Monitor Soil Moisture

Soil probe

Soil sampling tube

Drought


3 Years Ago
2 Years Ago
1 Year Ago
1 Week Ago
Currently
Intensity:
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought


Food Grows Where Water Flows

- Recently Transplanted Plants are at Greatest Risk of Drought Damage Due To Root Loss.

- Established Plants are Less at Risk.

Recognizing Early Signs of Drought Stress is Important Because:

- Irreversible damage can occur that no amount of watering will correct
- Mature fruit trees and landscape trees are worth saving.

Common Symptoms of Drought Include:

- Wilting or drooping leaves that do not return to normal by evening
- Curled or chlorotic (yellow) leaves that may fold or drop
- Foliage that becomes grayish and loses its green luster
- New leaves that are smaller than normal
- Lawns that retain a footprint for several minutes


Hosta Drought Damage


Turf Drought Damage


Drought
Stress

Maintaining Various Types of Plants During Water Restrictions and Severe Drought

Ornamental Trees

- Most homeowners wisely choose to use whatever water is available to save their mature landscape ornamentals and fruit trees.
- One or two deep irrigations with a garden hose several weeks apart in spring and summer will often keep these valued plants alive, especially if roots are relatively deep.

(Con’d)

- Two seasons without enough water can result in severe drought stress and even death.
- Drought-stressed trees are more prone to damage from diseases and insects than non-stressed trees.

Engraver Beetles


UC Statewide IPM Project
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(Con’d)

- Watering with a garden hose slowly and deeply will help water reach the root zone. Soaker hoses work well, too.
- Water mature trees several feet out from the trunk and make sure water is moving through the soil several inches deep into the root zone.

Fruit and Nut Trees

- Keeping fruit and nut trees alive during severe water shortages is also possible, although crop production will be reduced or stop.
- To produce a good crop, deciduous fruit and nut trees need adequate water in their root zones continuously from bloom until harvest.

Peaches, Plums, and Nectarines

- Adequate irrigation during the final 4 – 6 weeks before harvest is important to produce fruit. If necessary, reducing water just prior to this period and after harvest are viable strategies.
- If little or no irrigation water is available throughout the season, trees may be kept alive by severely cutting scaffolds back to the trunk (dehorning).

Citrus

- Citrus trees need adequate soil moisture during spring to set fruit and steady water in summer and fall to produce acceptable size, numbers, and quality of fruit.

Vegetables

- Vegetables are difficult to maintain during a drought.
- As a rule of thumb, water is most critical during the first few weeks of development, immediately after transplanting, and during flowering and fruit production.

(Con’d)

- Tomatoes, beans, and root crops such as carrots require regular watering and are not tolerant to long, dry periods. Vine crops such as squash and zucchini often fare better and can be kept alive with a few waterings once or twice a week through the season.

Shrubs

- Most established shrubs can survive long periods of dry soil. Thorough spring watering and one or two thorough waterings in the summer keeps most well-established shrubs alive for at least one season.

Groundcovers

- Groundcovers often survive on about half the amount of water received under optimal conditions, although some dieback may occur.
- To avoid serious drought stress groundcovers require waterings every 3-6 weeks from spring through fall depending on species and soil type and microclimate.

Lawns

- Warm-season lawns such as bermudagrass and buffalograss are more drought-resistant than cool season grasses such as tall fescue and ryegrass and may come back after several weeks of dryness. Cool season grasses may die within a month or two of receiving no water.
- Cutting the length of irrigation down to ½ of that recommended in the UC lawn watering guide (http://anrcatalog.ucdavis.edu/pdf8044.pdf) and watering only once or twice a week may help lawns survive drought.

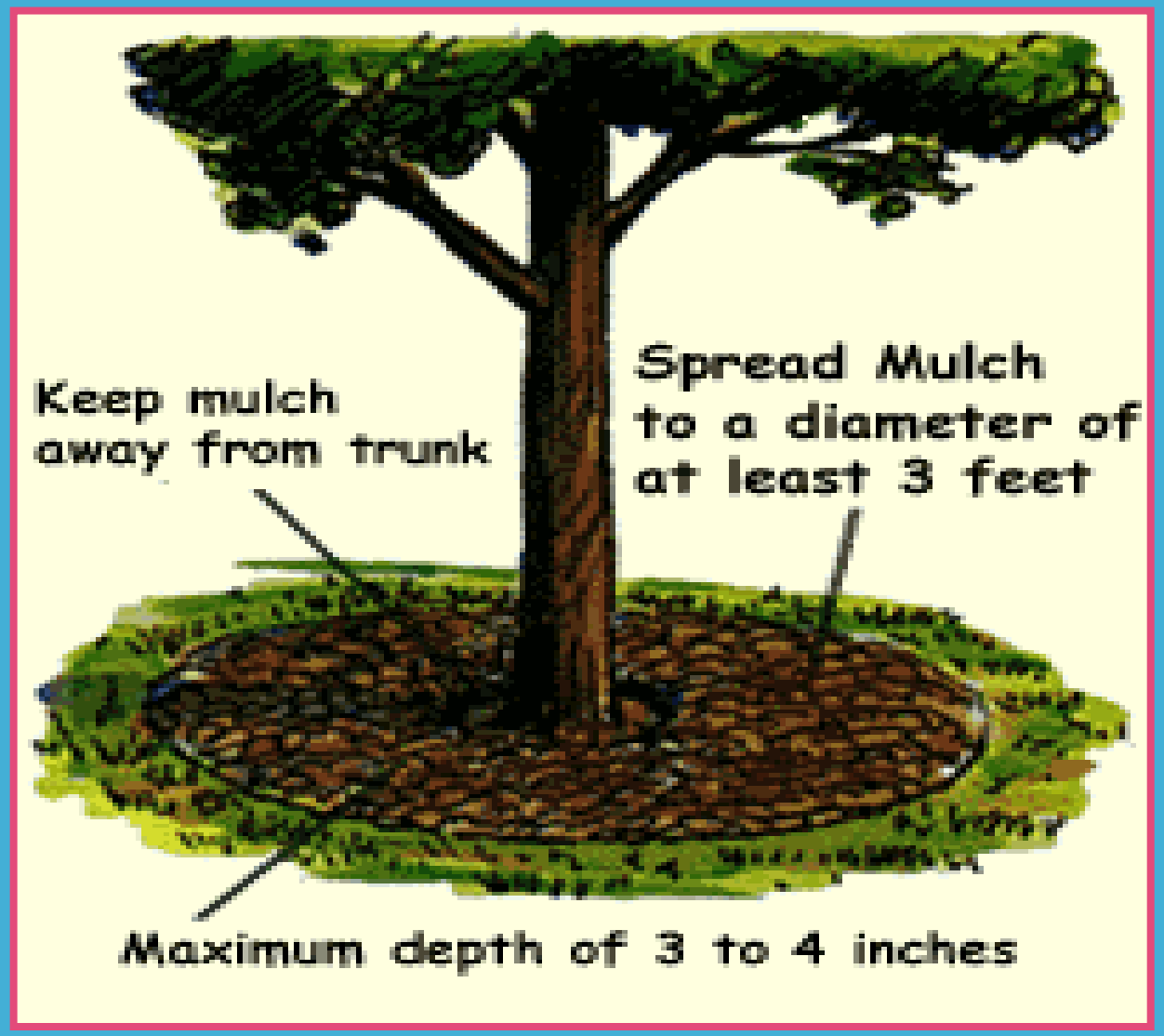
(Con’d)

- Once a lawn stops receiving adequate moisture, it will gradually turn brown and go dormant over time. A lawn that recently turned brown from drought can often be revived with regular, thorough watering.

What Else Can You Do Right Now Without Starting Over?

Mulch

- Apply 2-3” of mulch around garden plants and trees to hold water in and reduce soil evaporation.
- Keep it several inches away from tree trunks!
- Make sure to water beneath the mulch.



What Mistake Do You See?

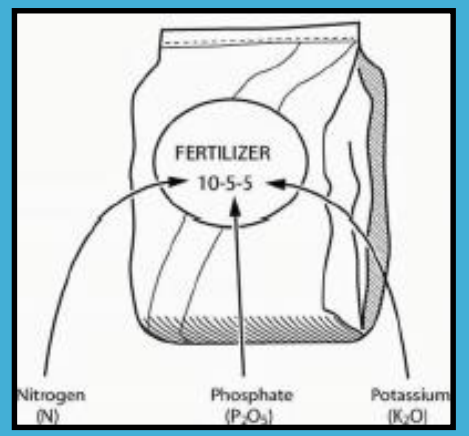
Mulch Volcano!

Avoid Planting New Plants

- Young plants require frequent irrigation until established and should not be planted during a drought or under water restrictions.
- Even native plants require continually moist root zones during establishment.

Avoid Overfertilizing

- Too much nitrogen results in lush, weak new growth, and increases the need for even more water.
- Too much fertilizer can lead to pollution of waterways.



Iron Chlorosis

Keep Weeds Out

- Weeds often outcompete garden plants and trees for water.
- Avoid using chemical herbicides; hand-weed instead. Overuse of pesticides can lead to waterways pollution.

Use a Broom Instead of a Hose to Clean up After Gardening/Pruning

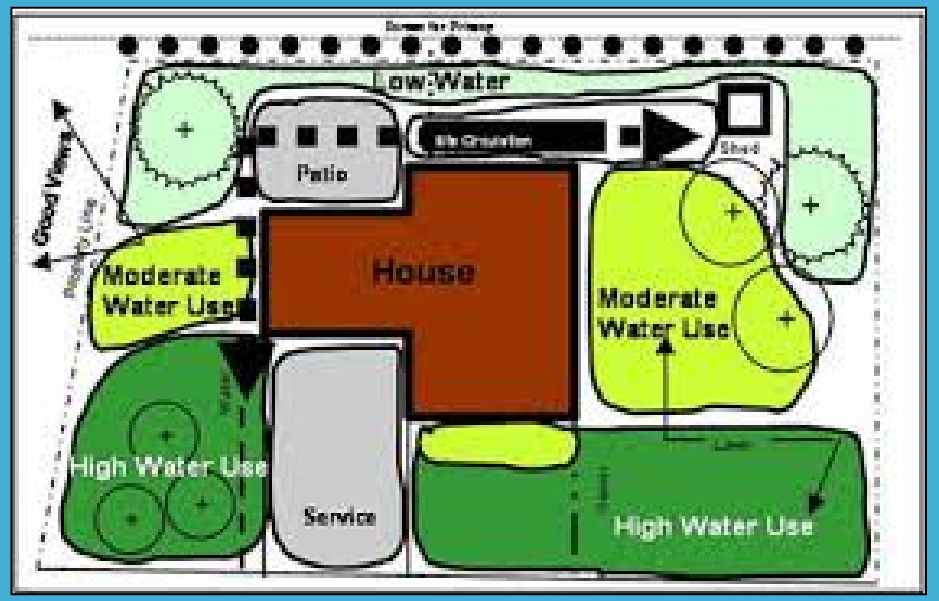
- Save water and avoid polluting waterways.
- Get some exercise.

What about Long-Term Solutions?

- Continue to schedule irrigations based on plant water requirements and follow other best management practices previously discussed. (People waste water - not plants.)

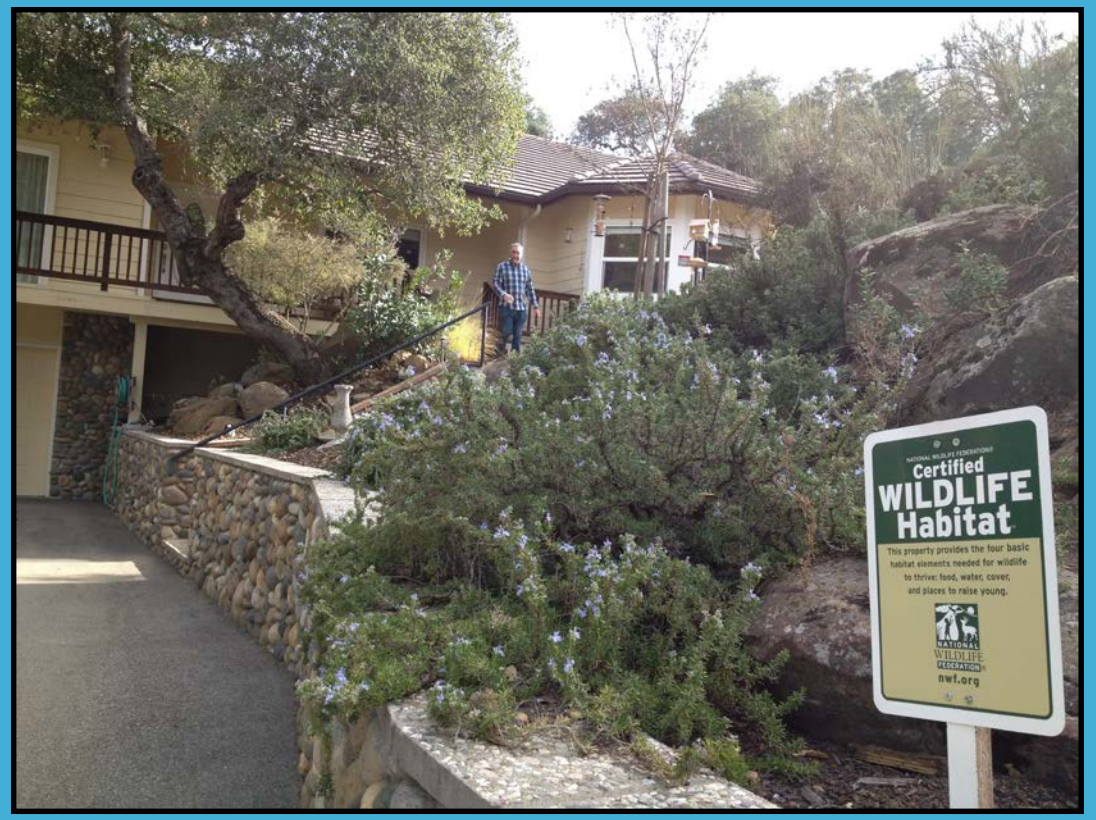
- If you are no longer enjoying your lawn, replace it with drip irrigated water efficient plants. Select new plants based on climate zone and microclimate.
- Hydrozone: place plants with similar water needs together.

Hydrozones
Source: Santa Clara Valley Water District, "Rules of Thumb for Water-Wise Gardening"



Long Term Solutions (con'd)

- Before planting, mix compost evenly several inches into garden soil to hold water in longer and decrease the chance of waterway pollution from runoff (clay soils) or draining below the root zone into groundwater (sandy soils).
- Add 2-3 inches of mulch on top of garden soil and around trees and shrubs, keeping it several inches away from tree trunks.
- Consider adding a graywater system if legal in your jurisdiction. (Graywater systems reuse water from washing machines and showers.) Never apply graywater to edibles or edible plant parts!

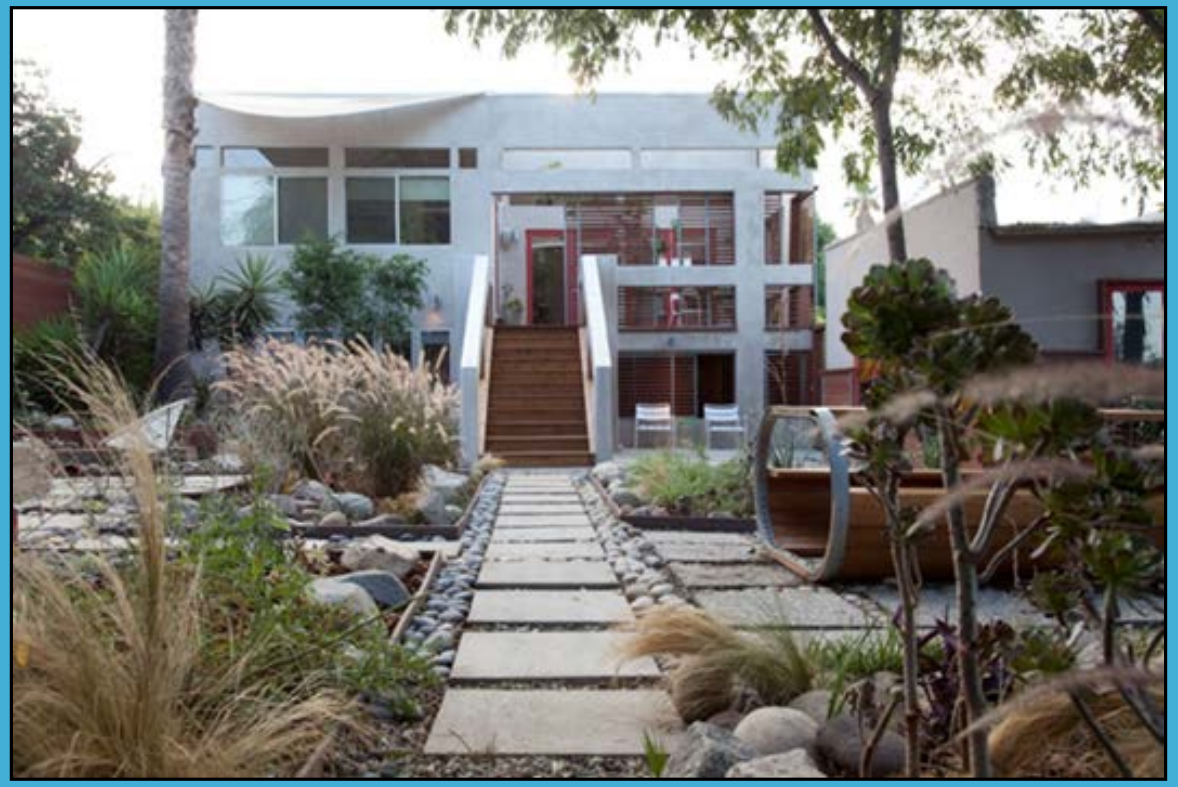


Beautify Your Landscape, Protect the Environment, and Save Water, Money, and Time!

Major UCCE Drought Resources

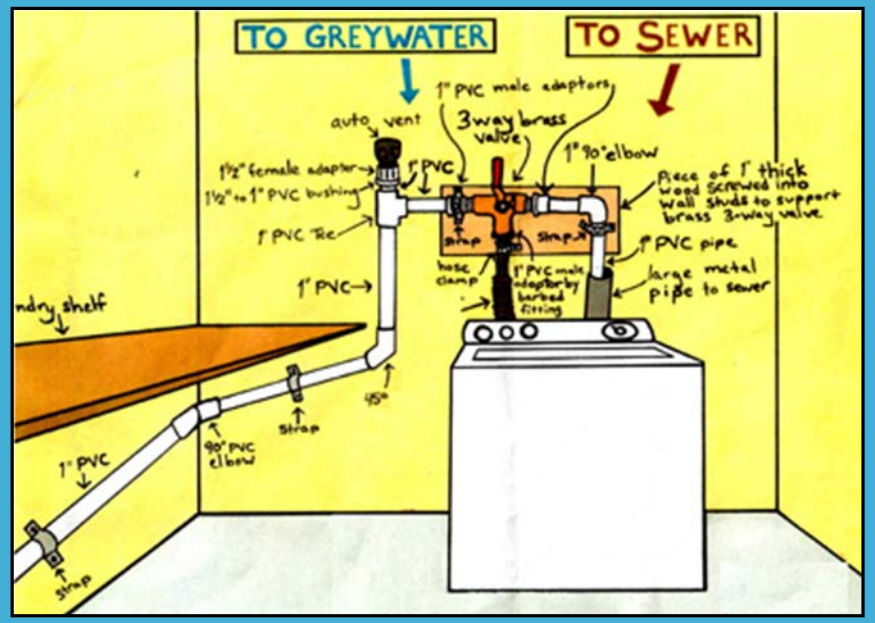
- Up to date local drought information: http://ceventura.ucanr.edu/
- Graywater Use Publication: http://anrcatalog.ucdavis.edu/details.aspx?itemno=8536
- Sustainable Landscaping in California publication: http://anrcatalog.ucanr.edu/details:aspx?itemno=8504
- Lawn Watering Guide: http://anrcatalog.ucanr.edu/integratedpestmanagement/8044.aspx.

Use of Graywater to Irrigate California Landscapes



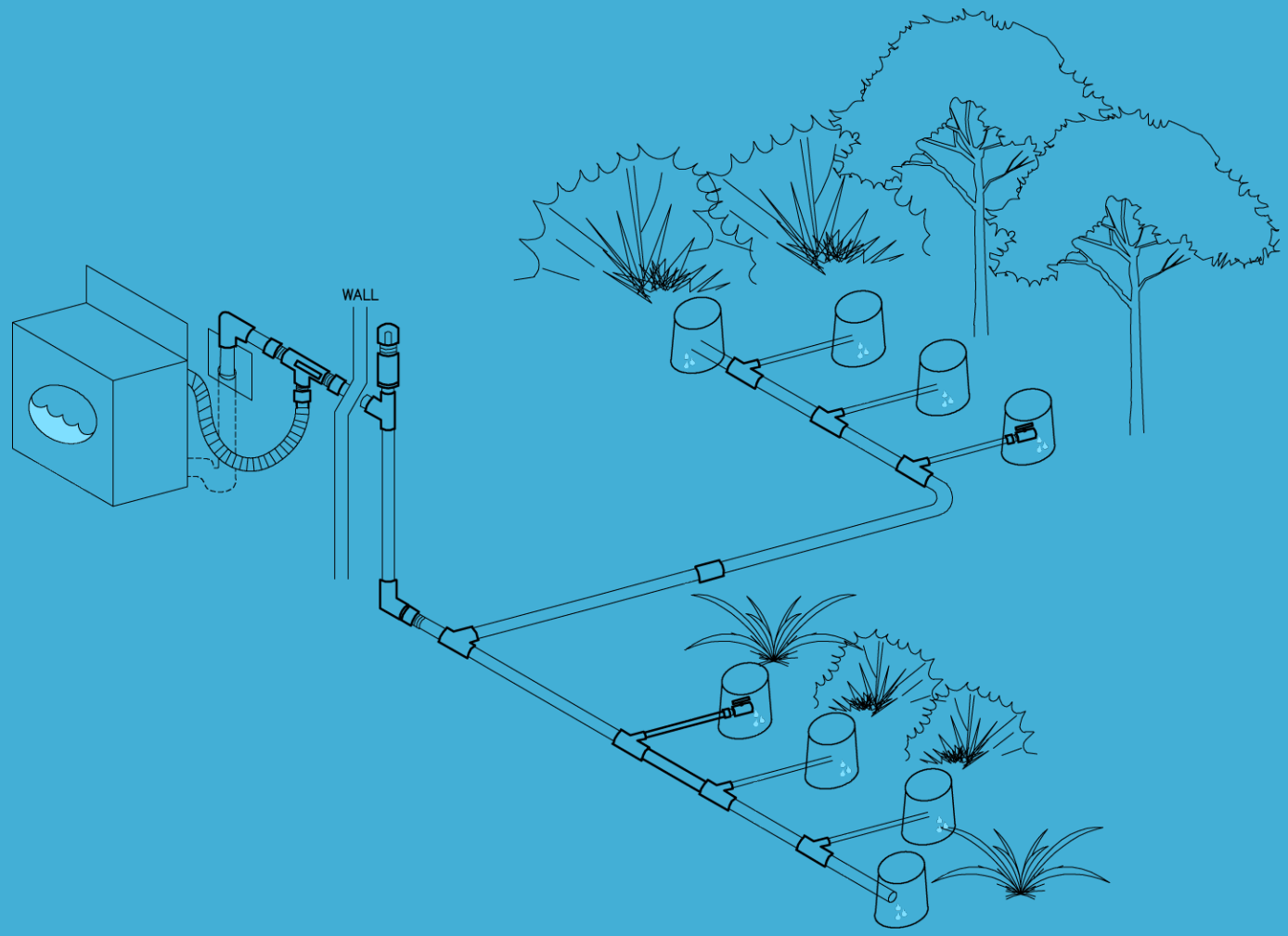
The use of graywater (also spelled greywater, grey water and gray water) to irrigate landscape plants is increasing throughout the united states, particularly in California and other arid states. Municipalities are rapidly amending their codes to encourage the use of home graywater systems.

A construction permit is no longer required for the installation of a single-family or two-family residential graywater irrigation system from a washing machine to an outdoor irrigation or disposal field as long as it does not alter the household plumbing.

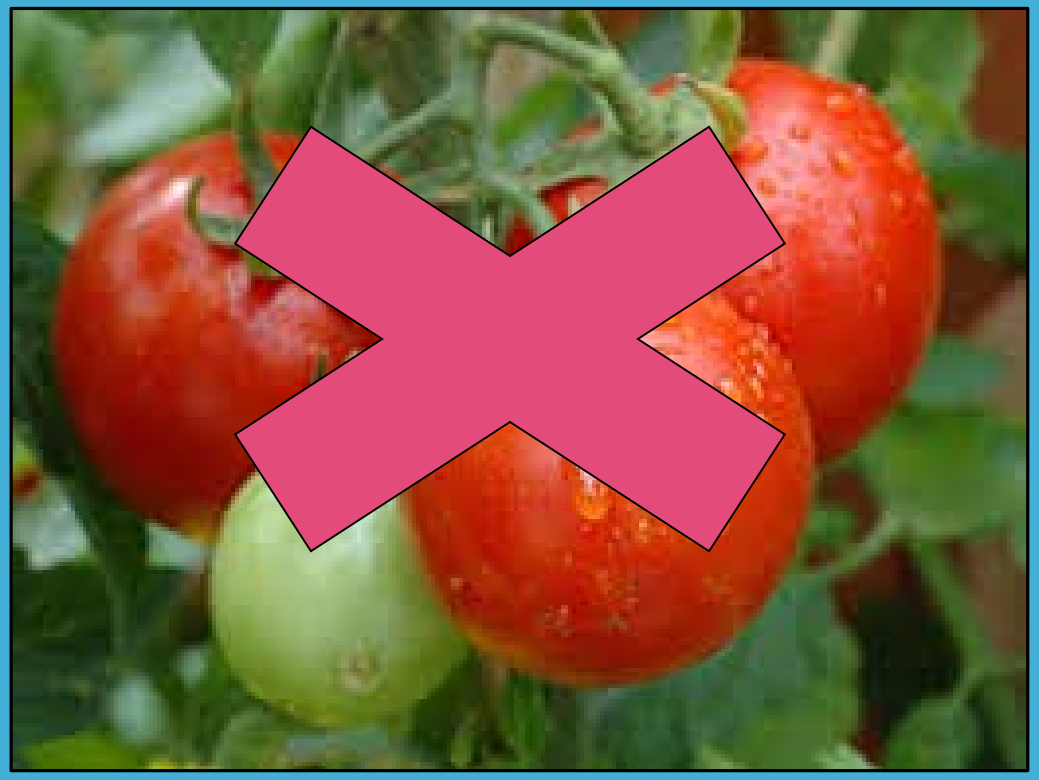


How Much Graywater Can be Generated?

- Between 10 And 25 Gallons Per Washing Machine Load Is Generated From A Horizontal Drum Machine (Side Loader)
- About 40 Gallons Per Washer Load Is Generated From A Top Loader.


WALL

Due to low but potential health risks, graywater should not be used to irrigate - or come into contact with - edible plants



Affordable housing project in Los Angeles (Casa Domingues) irrigated with a large, complex graywater system

- Graywater is often directed to mulch basins constructed by replacing several inches of soil with coarse organic mulch
- They work well for irrigating flower beds and small ornamentals
- However, basins constructed within the drip line of mature trees are not recommended and can result in injury to established roots and unstable and unsafe trees

Know Your Soil (Type) Texture
(graywater regulations require no puddling!)

Table 16A-2 Design Criteria of Six Typical Soils

Type of Soil	Square Feet	Gallons	Square Meters	Liters
	Minimum square feet of irrigation/leaching area per 100 gallons of estimated graywater discharge per day	Maximum absorption capacity in gallons per square foot of irrigation/leaching area for a 24-hour period	Minimum square meters of irrigation/leaching area per liter of estimated graywater discharge per day	Maximum absorption capacity in liters per square meter of irrigation/leaching area for a 24-hour period
Coarse sand or gravel	20	5.0	0.005	203.7
Fine sand	25	4.0	0.006	162.9
Sandy loam	40	2.5	0.010	101.8
Sandy clay	60	1.7	0.015	69.2
Clay with considerable sand or gravel	90	1.1	0.022	44.8
Clay with small amounts of sand or gravel	120	0.8	0.030	32.6

Graywater Can Keep 4-8 Landscape Trees Alive

Download the new free UC ANR ‘Graywater Use in California’ Publication: http://anrcatalog.ucdavis.edu/details.aspx?itemno=8536

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Thank You for Your Service as a UCCE Master Gardener

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