



Water Use Classification of Landscape Species

# WUCOLS IV 2014

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(Years of participation in parentheses)

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- American Society of Landscape Architects (CCASLA)
- Cagwin & Dorward Landscape Contractors
- California Association of Nurseries and Garden Centers (CANGC)
- California Landscape Contractors Association (CLCA State)
- California Landscape Contractors Association (San Diego Chapter)
- Glenn Schmidt Landscaping, Inc.
- Regional Water Authority (Northern California)
- San Diego County Water Authority
- Water Forum

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## INTRODUCTION

Water conservation is an essential consideration in the design and management of California landscapes. Effective strategies that increase water use efficiency must be identified and implemented. One key strategy to increase efficiency is matching water supply to plant needs. By supplying only the amount of water needed to maintain landscape health and appearance, unnecessary applications that exceed plant needs can be avoided. Doing so, however, requires some knowledge of plant water needs (Fig. 1).



Fig. 1. Water conservation in landscapes requires an understanding of plant water needs.

WUCOLS IV provides evaluations of the irrigation water needs for over 3,500 taxa (taxonomic plant groups) used in California landscapes. It is based on the observations and extensive field experience of thirty-six landscape horticulturists (see the section "Regional Committees") and provides guidance in the selection and care of landscape plants relative to their water needs.

### ***Project Background***

The WUCOLS project was initiated and funded by the Water Use Efficiency Office of the California Department of Water Resources (DWR). Work was directed by the University of California Cooperative Extension, San Francisco and San Mateo County office. The first edition of the guide was completed in 1992. A second edition was published in 1994, and a third edition in 1999. In each new edition, additional species were evaluated and included.

### ***Current Update: The 4th Edition***

The 4th edition represents a substantial expansion in the number of plant evaluations. Over 1,500 entries have been added to the 3rd edition list, for a total of 3,546 entries. Essentially, the great majority of taxa available from wholesale nurseries in California are included.

Unlike the 3rd edition, the 4th edition includes evaluations of many cultivars and hybrids. For a number of species (e.g., *Ceanothus* spp.), water needs of cultivars were thought to be sufficiently different than water needs of the species and were evaluated separately. In addition, a number of cultivars do not have a specific epithet, such as *Erysimum* 'Bowles Mauve', and the species from which it is selected is not obvious. Hence, only the cultivar could be listed.

In addition, a number of species evaluations made in previous editions were revisited by the regional committees. If the committees believed that the evaluation

of plant water needs should be changed (raised or lowered), it was changed. In some cases, a “?” was replaced by VL, L, M, or H (see the section “Categories of Water Needs”). As a result, users should be aware that species assignments from WUCOLS I, II, or III may not be the same as those found in WUCOLS IV.

### ***Project Rationale and Goal***

It is well understood that plants vary in their irrigation water needs. Some species require very little or no water during the summer months, while others need relatively large amounts. Unfortunately, there is no authoritative resource that identifies the specific water needs of landscape plants. Certainly, field research has been conducted that identifies the water needs of some species, but this amounts to a very small percentage (less than 1%) of the species available in California wholesale nurseries. Furthermore, due to the resource challenges involved in conducting this research, it is unlikely that another 1 or 2% of species will be evaluated in the near future.

Considering the paucity of research-based information, it was reasoned that compiling information based on the collective experience and knowledge of leading horticulturists in California was far better than providing little or no guidance. This project was based largely on that rationale. Essentially, our goal was to provide users with the most comprehensive and up-to-date information available from the best sources in California. In considering the extent of the list and the extensive experience and knowledge of the regional committees involved, we believe this goal has been achieved.

### ***Use of the WUCOLS List***

Originally, the intent of the WUCOLS project was to provide guidance to landscape professionals regarding the water needs of landscape species. This continues to be the intent. Specifically, it can be used to

- assist landscape architects, designers, and planners in selecting plants for water-efficient landscapes.
- assist landscape managers in evaluating water needs of existing plantings and in creating irrigation schedules that match species needs.
- assist landscape managers who seek to modify the species composition of existing landscapes to reduce variation in water needs and create effective hydrozones.
- provide support information for formulae used to estimate water needs for new or existing landscapes.

**Note:** Water agencies and local authorities may opt to use WUCOLS evaluations to help meet conservation goals. When doing so, however, agencies and users must be familiar with how the evaluations were made and the specific limitations on their use. This information is provided in the following sections that describe the evaluation process, define the categories of water needs, and identify symbols used in the list.

## **GETTING STARTED: FIRST-TIME AND PRIOR USERS**

If you are using the WUCOLS list for the first time, it is very important that you begin by reading the sections "The Evaluation Process," "Categories of Water Needs," "Standard Conditions," "Plant Types," and "Regions."

If you have used the list before and are familiar with the terms and the evaluation process, proceed directly to the section "Species Evaluations." Be advised, however, that new information has been added to WUCOLS IV.

The following will help you locate information on important topics.

What do High, Moderate, Low, and Very Low mean? See the section "Categories of Water Needs," page 8.

What are Standard Conditions? See the section "Standard Conditions," page 10

What is meant by "plant types?" See the section "Plant Types," page 12

What are the regions? See the section "Regions," page 13.

How do I calculate the amount of irrigation water to apply? Refer to the Model Water Efficient Landscape Ordinance (MWELo)

[http://www.water.ca.gov/wateruseefficiency/docs/MWELo\\_TbContent\\_Law.pdf](http://www.water.ca.gov/wateruseefficiency/docs/MWELo_TbContent_Law.pdf).

For other important information you need to know when using WUCOLS evaluations, see page 14.

## **THE EVALUATION PROCESS**

Species were evaluated by committees of horticulturists representing six different climatic regions of California (see the section "Regions"). Selection of committee members was based on knowledge of landscape plants and experience growing a large number of species in the respective region. Essentially, the best professional horticulturists available in the region were invited to participate in the project.

Assignments were based on a committee member's experience growing the plant or observing it in the region of California being considered --- not in another part of California or the world. For example, if a committee member had observed a plant only in South Africa, this was not taken as a basis for making a water needs assignment in the region of California under consideration. However, if that member had observed the plant in the California region in addition to South Africa, the observations in South Africa would be included in the evaluation.

Committees represented the following regions of California: North-Central Coastal, Central Valley, South Coastal, South Inland, Low Desert, and High and Intermediate Desert. For a listing of members in each region, see page 1. For a listing of representative cities in each region, see page 13.

Multiple meetings were held in each region in 2013, with committee members reviewing all plants added to the WUCOLS list. In addition, some prior evaluations were revisited and changed if deemed warranted by the committee. The key question addressed by each committee was:

*In order to be maintained in good condition in the region of California being considered, and under the standard conditions outlined, does the species need a high, moderate, low, or very low amount of irrigation water?*

This question served as a starting point for the evaluation process. Prior to making evaluations, however, each committee received instruction on water needs categories and standard conditions. A consensus-based approach was used in which committee members discussed the species, and decided on an appropriate water needs category.

### CATEGORIES OF WATER NEEDS

Category	Abbreviation	Percentage of ET <sub>o</sub>
High	H	70-90
Moderate	M	40-60
Low	L	10-30
Very Low	VL	< 10



Fig. 2. Five-finger fern was assigned to the “high” water needs category in four regions.

Species were evaluated as needing high (H), moderate (M), low (L), and very low (VL) amounts of irrigation water. Expressed as a percentage of reference evapotranspiration (ET<sub>o</sub>)\*, these categories were quantitatively defined as follows. Water needs categories were assigned for each species in each of the six regions. The category High contains species requiring the greatest amount of water during the summer months to maintain acceptable health, appearance, and growth, such as white alder (*Alnus rhombifolia*) and five-finger fern (*Adiantum aleuticum*) (Fig. 2). Species in the category Moderate need lesser amounts of water, such as ivy geranium (*Pelargonium peltatum*) and cone flower (*Echinacea* spp) (Fig. 3). Species in the category Low are considered to be water conserving because they perform well with relatively small amounts of irrigation water, such as carob (*Ceratonia siliqua*) and strawberry tree (*Arbutus unedo*) (Fig. 4). Species assigned to

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\* For further information on ET<sub>o</sub>, see the Model Water Efficient Landscape



the category Very Low were classified as needing no irrigation except during years of below average rainfall for the region, such as chamise (*Adenostoma fasciculatum*) and Matilija poppy (*Romneya coulteri*) (Fig. 5).

If disagreement existed regarding a category, the higher category was assigned. For instance, if some members thought a species was in the category Low, while others thought it was in the category Moderate, it was assigned to Moderate. With this in mind, users should be aware that lesser amounts of water may be used for a species, but greater amounts generally will not be warranted.

If the committee was not familiar with the species or did not have experience growing it in the region, a “?” was assigned. This does not imply that the species should not be planted and tested in the region, however.

If the committee did not think the species was appropriate for the region, a “/” was assigned. The performance of these species was believed to be truly unsatisfactory for the region. For instance, species that grow in the North-Central Coastal region were considered to be not appropriate for the Low or High Desert regions. Additionally, species that are frost sensitive were considered to be not appropriate for the Central Valley.

In some cases, all species in certain genera were evaluated as a group (e.g., *Dianthus* spp.). Essentially, all species of these genera were thought to have similar water needs.

Many species on the WUCOLS list can be irrigated at levels lower than those identified by regional committees. In some cases, such a reduction in irrigation will mean survival of the plant but not necessarily good performance. For example, many California native species are adapted to summer-dry conditions and survive from year to year, but



Fig. 3. Cone flower was assigned to the “moderate” water needs category in all regions.



Fig. 4. Strawberry tree was assigned to “low” water needs category in four regions.



Fig. 5. Matilija poppy was assigned to the “very low” water needs category in four regions.

their performance and appearance may be compromised. For the WUCOLS project, species were not evaluated for survival levels of irrigation. Rather, category assignments were based on an assessment of the level of water needed to maintain satisfactory health, appearance, and growth (see the section “Standard Conditions,” below).

### STANDARD CONDITIONS

The following standard conditions were used by regional committee members when making water needs assignments.

#### ***Established Plants***

Water needs are determined for plants that have become “established” in the landscape (Fig. 6). “Established” means that substantial root development has occurred in the soil adjacent to the root ball; that is, the landscape soil becomes the principal reservoir of water rather than the root ball soil. The time for establishment varies among species and with soil conditions, but it generally occurs by the second or third year after planting. After establishment, roots of trees, shrubs, groundcovers, etc., become intertwined in the soil, creating a common root zone.



Fig. 6. WUCOLS evaluations were made for plants that have become “established” in the landscape --- not for newly-planted plants.

#### ***Reference Evapotranspiration (ET<sub>o</sub>) Conditions***

ET<sub>o</sub> is defined as water loss from a large field of cool-season grass 4 to 7 inches tall that is not water stressed. Although ET<sub>o</sub> can be measured directly, it is usually calculated from weather data. Daily ET<sub>o</sub> information for many regions of the state is available through the California Irrigation Management Information System (CIMIS). Evaluations are made for site conditions equivalent to those used for ET<sub>o</sub> measurements, such as full sun, no extraordinary winds, no shading from nearby structures or plants, and no heat inputs from nearby sources such as buildings, pavements, or reflective surfaces.

As an exception, shade-requiring species, such as Japanese aucuba (*Aucuba japonica*), are evaluated for shade conditions. Shade species are considered to be plants that show visible injury when exposed to full sun for some part of the day. Since species vary in their shade requirements, any species requiring some shade to avoid injury in the region is evaluated for shade.

### ***Good Quality***

Plant performance can vary substantially, depending on the amount of water supplied. Small amounts may simply prevent dehydration of plant tissues, but appearance is likely to be affected. Increasing amounts may improve appearance (leaf color, canopy density or fullness), but may not be enough to promote growth. Additional water may be sufficient to maintain good appearance and support typical (average) growth for the species (and flower and fruit production, if desired). Still more water may result in excessive growth, and even more water may cause decline (typically from root disease) in certain species. Since both appearance and growth are important in landscapes, evaluations estimated the level needed to maintain the species in good condition (Fig 7). Whenever a question was raised as to whether a species required a greater or lesser amount of water to maintain good condition, the higher water need category was assigned.



Fig. 7. Taxa were evaluated for the amount of water needed to maintain good quality.

### ***Groundwater Not Available***

Although some species of plants develop root systems deep enough to extract groundwater, such as valley oak (*Quercus lobata*), groundwater is not available in all planting sites. A species capable of extracting groundwater may not be able to do so simply because water is not available. Therefore, evaluations were made for conditions where the only sources of water are rainfall and irrigation. In areas where groundwater is available and a species is known to have the capacity to use groundwater, adjustments in irrigation scheduling should be made for that species or group of species.

### ***Plants Must Be Irrigatable***

In some cases, the soil surface around plants may be covered with impermeable pavements or other materials. This is particularly the case for trees in parking lots or along streets. Such pavements act as barriers to the infiltration of water into the root zone, making the plants very difficult to irrigate. In other cases, the soil volume capable of holding water may be so small and may dry so rapidly that it becomes very difficult to maintain available water in the root zone. In both cases, the amount of water identified as being needed to maintain good quality may not be sufficient simply because the plants are not irrigatable. Our evaluations assume as a standard condition that the species can be irrigated, that is, that applied water can enter and be held in the root zone long enough for plant uptake.

## PLANT TYPES

The WUCOLS list includes over 3,546 entries of landscape plants (species, cultivars, and hybrids) that are identified by botanical and common names. The plants are listed alphabetically according to botanical names.

Each plant falls into one or more of the following vegetation types, shown with a corresponding symbol (Fig. 8).

Vegetation Type	Symbol Used in WUCOLS List
bamboo	Ba
bulb	Bu
grass	G
groundcover	GC
perennial*	P
palm and cycad	Pm
shrub	S
succulent	Su
tree	T
vine	V
California native	N

\* Perennials that are principally herbaceous

If a plant is considered to have more than one vegetation type (e.g., it has both tree and shrub forms), it is identified as such.

### ***Turfgrass Species***

Turfgrass species were not evaluated by the regional committees. Water requirements for turf species are given in Appendix 1 (see p. 18). Water use requirements are taken from *Managing Turfgrass During Drought* (University of California ANR Publication 8395). This publication also contains other important information regarding turfgrass irrigation, such as plant performance at varying irrigation levels, drought resistance, and rooting depths of species.

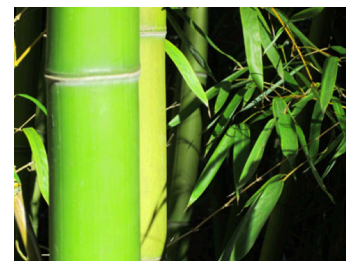


Fig. 8. In the WUCOLS IV list, plants are identified by botanical name, common name, and vegetation type.

## REGIONS

Since substantially different climate zones exist in California, species were evaluated for regions that represent six different climatic conditions. These are not the only

climate zones that exist in California, but they include much of the state where irrigated landscapes occur. For locations outside of the six regions, it is best to use species evaluations from a region that is most similar climatically to the location of interest.

Number	WUCOLS Region	Sunset climate zones*	CIMIS ET <sub>0</sub> zones**	Representative Cities
1	North-Central Coastal	14, 15, 16, 17	1, 2, 3, 4, 6, 8	Healdsburg, Napa, San Jose, Salinas, San Francisco, San Luis Obispo
2	Central Valley	8, 9, 14	12, 14, 15, 16	Auburn, Bakersfield, Chico, Fresno, Modesto, Sacramento
3	South Coastal	22, 23, 24	1, 2, 4, 6	Irvine, Los Angeles, Santa Barbara, Ventura, Vista
4	South Inland	18, 19, 20, 21	9	Corona, Escondido, Pasadena, Riverside, San Bernardino, Santa Paula
5	High and Intermediate Desert	11	14, 17	Apple Valley, Barstow, Bishop, Lancaster, Lone Pine, Tehachapi
6	Low Desert	13	18	Borrego Springs, Blythe, Death Valley, El Centro, Needles, Palm Springs

\*See Brenzel, K. N., ed., *Sunset Western Garden Book* (2012).

\*\*See CIMIS ET<sub>0</sub> Zone Map,

<http://www.cimis.water.ca.gov/cimis/cimiSatEtoZones.jsp>

### ***Notes on Regions***

Within each region there may be variability in climate patterns among the cities listed. For example, some cities may be considerably warmer than others during the summer months, yet they are within the same region. This variability could be reduced only by increasing the number of regions, which would enlarge the list beyond the scope of this project.

For locations considered atypical for the region, it may be useful to consider evaluations from another region that more closely characterizes the location of interest. For example, if a city in Region 1 has a climate more similar to cities in Region 2, consider Region 2 evaluations for that location. Of course, such assessments must be based on the experience and judgment of the user.

If a city is not listed and is located in California climate zone 14, for example, which overlaps Regions 1 and 2, it will be necessary to decide whether the city is more similar climatically to Petaluma (coastal influence) or the Sacramento Valley.

If a city is located in a California climate zone that is not evaluated (mainly high-elevation, cold-winter areas), a species' water needs may be estimated by looking at all the evaluations for the species in question, then selecting the evaluation considered most appropriate. Clearly, in these cold-winter areas, hardiness is the major factor to consider.

The principal difference between the California high and intermediate desert regions is that the high desert is colder in the winter: as the elevation increases, so does the frequency of temperatures below freezing. As a result, species that are listed as appropriate for the low desert and inappropriate for the high desert may be marginally hardy and appropriate to try in the intermediate desert.

## **USING WUCOLS EVALUATIONS**

### ***WUCOLS Evaluations and Plant Cultural Requirements***

Simply because a species is found on the WUCOLS list does not mean that it is recommended for planting. The user has the responsibility to understand the suitability of a species for planting in a particular location. In some cases, a species may be considered to be invasive in the region of interest and should not be planted (see the section "Invasive Species," below). In other cases, the species has cultural requirements that make it difficult to cultivate in the area, or it may be susceptible to pests that would make it a poor choice for the area. Regardless of the limitation, it is incumbent on the user to be aware of key limitations on the use of species in their region.

### ***Variation in Regional Evaluations***

In reviewing the evaluations across regions, some apparent inconsistencies may be seen. For instance, variegated Chinese lantern (*Abutilon pictum*) is in the category High in the Central Valley, but it is in Moderate in the South Inland region. Why was more water thought to be needed for this species in Sacramento than Riverside?

Unlike the South Inland region, the Central Valley experiences summer winds that cause this species to perform poorly if not irrigated at a relatively high level. In another case, Engelmann oak (*Quercus engelmannii*) is in the category Very Low in the South Coastal region and Low in the North-Central Coastal region. Why might this species need more water in a relatively cooler area? This evaluation was based on the North-Central Coastal regional committee's collective experience that Engelmann oak needs more water when grown outside of its native range. Although evaluations for many species are similar across regions, it is important to recognize that apparent inconsistencies are often a consequence of differences found in species performance from region to region.

### ***Invasive Species***

Clearly, species that are considered to be invasive in a region should not be used. Users are referred to authoritative lists of invasive species, such as can be found in the California Invasive Plant Council (CA IPC) website, <http://www.cal-ipc.org>. In this update of the WUCOLS list, there is no determination as to whether a species is invasive. Largely, this is because species that are invasive in one region may not be invasive in another region. It is important to designate plants as invasive on a local or regional basis rather than on a statewide basis. If a species has been identified by a credible source as being invasive for a location, it should not be used.

### ***Water Stress and Insect Injury***

Although some species perform well with little or no irrigation water, their susceptibility to insect attack and injury may increase with water stress. For example, many *Eucalyptus* species perform well in nonirrigated locations in many parts of California. When water stressed, however, they become susceptible to attack and injury by the eucalyptus longhorned borer (*Phorocantha semipunctata*). This is also the case for Monterey pine (*Pinus radiata*) and the California fivespined engraver beetle (*Ips paraconfusus*). For these species, evaluations were made with consideration given to water stress and pest interactions. For example, although Tasmanian blue gum (*Eucalyptus globulus*) performs well in Regions 3 and 4 with little summer water, it was assigned the category Moderate to minimize susceptibility to borer injury.

### ***Using Species Not Found on the List***

Although WUCOLS IV includes the great majority of species available in the wholesale nursery trade in California, it does not include all such plants. If a species is not listed here, it does not mean it cannot be submitted to an agency or organization for compliance with efficient water use in landscaping. The person who submits the species to the agency or organization must provide justification for a water-needs category for the species. This justification could come from a published source or a recognized authority, such as a person who specializes in the cultivation of the species. Alternatively, the species can be submitted for review by WUCOLS regional committees via the WUCOLS website (<http://ucanr.org/sites/wucols/>).

## **Shade**

As noted in the section “Standard Conditions,” most species were evaluated for full sun conditions. Light intensity and duration vary with seasons, microclimates, and proximity to the coast. Many species that can be grown in full sun in coastal locations require a measure of shade in inland areas; others require some shade in all locations. Here, each species was evaluated for the conditions that would produce the best appearance (including flowering and/or fruiting) for the region. Consult horticultural literature (see the section “Resources” at the end of this publication) for more information on species light requirements.

## **Winter Irrigation**

Although many species are typically not irrigated during the winter, it may be necessary in the following cases:

- Sensitive deciduous species will benefit from irrigation in desert regions if warm winter winds dehydrate shoots and buds.
- During drought years or in desert climates, some evergreen species may need winter irrigation.
- Certain species planted outside of their natural range, such as coast redwood (*Sequoia sempervirens*), may need winter irrigation.

## **Summer-Deciduous Species**

As a drought adaptation, certain species shed their leaves when soil moisture levels become low, such as California buckeye (*Aesculus californica*) (Fig. 9). Usually, such species do not require irrigation and are assigned to the category Very Low. In cases of below average rainfall for the area or where retention of summer leaves is desired, irrigation may be needed.



Fig. 9. Summer-deciduous species, such as California buckeye, shed leaves when soil moisture levels become low.

## **Bulbs**

Water requirements for bulbs vary not only with species but also with dormancy period. Certain species are winter dormant, while others are summer dormant. Species that are summer dormant, such as naked lady (*Amaryllis belladonna*), should not be irrigated in the summer. Indeed, irrigation of this and similar species during the summer can lead to infection and decay (Fig. 10). Accordingly, summer-dormant bulbs are generally considered to have very low or low water needs. Conversely, winter-dormant bulbs generally need water in the summer while



Fig. 10. Summer-dormant bulbs, such as naked lady, do not need to be irrigated in the summer.



growing. Keep in mind that even summer-dormant bulbs may need some water in the winter in relatively dry regions, such as the desert. Also, some summer-dormant species, such as giant scilla (*Scilla peruviana*), can remain actively growing in the summer with irrigation.

### ***Container Plants***

WUCOLS evaluations do not apply to container plants (boxes, planters, pots, etc.). Standard conditions used for evaluations specifically exclude container plants and apply only to plants in the ground.

### ***Revegetation Species***

Some species on the WUCOLS list, such as California aster (*Lessingia filaginifolia*), are more commonly used in revegetation projects than in landscapes. For these species, water needs assignments are made for their use in landscapes where irrigation is supplied not simply for survival but also for attractive appearance and good performance.

### ***Turf Substitutes***

In Regions 1 through 4, common yarrow (*Achillea millefolium*) and dymondia (*Dymondia margaretae*) are evaluated as having low water needs. If these species are used as turf substitutes, however, their water needs may increase to moderate to maintain good performance. Generally, this applies to other species used as turf substitutes.

## **RESOURCES**

Brenzel, K. N., ed. 2012. *Sunset Western Garden Book*. 9th ed. New York: Time Home Entertainment.

California Invasive Plant Council (CA IPC) website, <http://www.cal-ipc.org>.

CIMIS ET<sub>0</sub> Zone Map website,  
<http://www.cimis.water.ca.gov/cimis/cimiSatEtoZones.jsp>.

Harivandi, A. M. 2009. *Managing Turfgrass During Drought*. Oakland: University of California Agriculture and Natural Resources Publication 8395,  
<http://anrcatalog.ucdavis.edu/pdf/8395.pdf>.

Model Water Efficient Landscape Ordinance (MWELO),  
[http://www.water.ca.gov/wateruseefficiency/docs/MWEL0\\_TbContent\\_Law.pdf](http://www.water.ca.gov/wateruseefficiency/docs/MWEL0_TbContent_Law.pdf).

## APPENDIX

Appendix 1. Water requirements for warm-season and cool-season turfgrasses. Data taken from *Managing Turfgrasses during Drought* (Harivandi et al, 2009). To access this publication, see “Resources”.

Type	Common name	Optimal Irrigation* (% ET <sub>0</sub> )	Deficit Irrigation** (% ET <sub>0</sub> )
Warm season	Common bermudagrass	60	40
	Hybrid bermudagrass	60	40
	St. Augustinegrass	60	40
	Seashore paspalum	60	40
	Zoysiagrass	60	40
	Buffalograss	60	40
	Kikuyugrass	60	40
	Cool Season	Tall fescue	80
Perennial ryegrass		80	60
Kentucky bluegrass		80	60
Fineleaf fescues		80	60
Creeping bentgrass		80	60
Rough bluegrass		80	60

\* Optimum irrigation is the amount of water needed for most efficient growth, maximum quality, and best appearance.

\*\* Deficit irrigation provides sufficient water to maintain adequate appearance with less growth (relative to optimum irrigation).

**Note:** For turfgrass blends, the species with the highest water requirement will generally determine the irrigation level for the blend. For instance, if a blend contained perennial ryegrass and common bermudagrass, then it would be irrigated at 80% ET<sub>0</sub> for optimal performance. If the sward appears to be overwatered, however, then a downward adjustment in irrigation level would be warranted.