

City of El Cajon Water Efficient Landscape Design Manual

The Planning Division has prepared this Landscape Design Manual to assist the public. This manual supplements Chapter 17.195 of the El Cajon Municipal Code and is intended to be a guide to assist in the design, maintenance, permitting, and installation of water efficient landscapes and irrigation systems.

The Landscape Design Manual contains four major sections:

Section One discusses basic principles related to water efficient landscaping.

Section Two includes a list of resources and Web links to aide in the planning, design, installation, and maintenance of water efficient landscapes.

Section Three includes sample calculations for projects requiring approval of a Landscape Documentation Package and Certificate of Completion. These examples are based upon hypothetical landscape projects and are intended to help applicants understand and complete the required Water Efficient Landscape Worksheet.

Section Four provides technical information, including the reference evapotranspiration rate (ET_0) for El Cajon. Section Four also provides a listing of drought tolerant, low water use plants that are appropriate for the inland valleys of Southern California, such as the El Cajon Valley.

Section One: Basic Water Efficient Landscape Principles

Basic Principles - Water is a costly and vitally important natural resource of statewide importance. In order to conserve this important resource, landscaped areas should be designed to use water as efficiently as possible. The following basic principles of water conservation in landscaping are simple. Adherence to these basic principles will help to prevent water waste, reduce monthly water bills, and ensure that landscaped areas continue to thrive:

Principle No. 1 - Plants have adapted to life in a variety of different climate regimes ranging from cold to hot and from wet to dry. In order to create a healthy and thriving artificial landscape that does not require frequent and costly supplemental watering, plants must be selected that are appropriate for the climate regime in which they are placed. In other words, if you live in a hot dry place, you should select plants that are adapted to survive in a hot and dry climate without the need for frequent supplemental watering.

Principle No. 2 – Turf areas and decorative water features consume large amounts of water. In order to reduce the amount of water necessary to maintain a healthy and thriving landscape, minimize the areas dedicated to turf and decorative water features.

Principle No. 3 – A much larger landscaped area may be maintained with the same amount of water required for a smaller area, if the plants selected are low water users. Assuming the presence of a fixed water budget, the selection of high water use plants significantly reduces the size of the planting area.

Principle No. 4 – An efficient irrigation system is necessary to maintain a cost effective, healthy, and water efficient landscape. The use of water efficient irrigation technology such as weather-based controllers, micro-spray emitters, bubblers and drip lines, is essential to water conservation efforts. The proper maintenance of irrigation systems is also essential to water conservation.

Principle No. 5 – Early morning watering helps prevent excessive evaporation. Evening watering is only second best because watering at night encourages fungal growth that can damage plants. Watering during the heat of the day is inefficient because much of the water applied to the landscape area is lost to evaporation.

Principle No. 6 – Excessive evaporation and run-off from landscaped areas can be minimized by the use of soil amendments and mulches that retain water and prevent soil erosion.

Section Two: Water Efficient Landscape Resources

Resources – The following agencies and resources are available to assist those interested in establishing and maintaining water efficient landscaping:

California Department of Water Resources – This state agency is responsible for coordinating and managing water resources at the state level. Their Website includes useful conservation information, printable brochures, and links to a variety of online resources dedicated to the management and conservation of water resources. To access these online resources, or to obtain telephone contact information for the Department of Water Resources, visit their Website at www.water.ca.gov.

San Diego County Water Authority – This is a public agency serving the San Diego region as a wholesale supplier of water. The Water Authority works through its 24 member agencies to provide a safe, reliable water supply to the San Diego region. Their Website offers online tools to assist water conservation efforts. To access these tools and other information related to water conservation, visit them on the Web at www.sdcwa.org.

Helix Water District – Helix Water District is the primary water purveyor for El Cajon. Helix offers free water use evaluation and consultation services to its customers upon request. Their Website offers online tools to assist water conservation efforts. To access these tools and services contact Helix Water District by phone at 619.466.0585 or visit them on the Web at www.hwd.com.

Padre Dam Municipal Water District – Padre Dam Municipal Water district provides water service to a limited area of El Cajon including Gillespie Field, the industrial area west of Gillespie Field, and a residential area located along the base of Fletcher Hills. This residential service area is located generally north of Grossmont College Drive and South of Weld Boulevard. Padre Dam offers free water use evaluation and consultation services to its customers upon request. Their Website offers online tools to assist water conservation efforts. To access these tools and services contact Padre Dam Municipal Water District by phone at 619.258.4680 or visit them on the Web at www.padredam.org.

Water Conservation Garden at Cuyamaca Community College – The Water Conservation Garden, or simply “The Garden,” is a non-profit corporation dedicated to promoting water conservation in the southern California landscape through excellent exhibits and programs that educate and inspire the public. The Garden has nearly five acres of displays that showcase water conservation through a series of beautiful themed gardens, such as a native plant garden and a vegetable garden. The Garden offers tours, classes, and functional exhibits on a variety of

landscape design and water conservation-related topics such as: irrigation system design and maintenance, rainwater harvesting, the use of mulch, etc. Contact The Garden by phone at 619.660.0614, or visit their Website at www.thegarden.org.

California Urban Water Conservation Council – The California Urban Water Conservation Council (CUWCC) is a partnership of water suppliers, environmental groups, and others interested in conserving California's water resources. Their Website provides a variety of on-line resources for those interested in conserving water in the home and in landscaped areas. Visit the CUWCC Website at <http://www.cuwcc.org/>.

Section Three: Examples

The following examples are based upon hypothetical landscape projects and are training aides for applicants that must complete the Water Efficient Landscape Worksheet.

Example One: This example is based upon a hypothetical landscape project located in El Cajon, CA, consisting of 10,000-square feet of irrigated landscaping at a new industrial development. This example includes 5 irrigation circuits controlled by a single programmable irrigation controller and one point of connection to the water main. There are no water features or special landscaped areas in this example. The landscape area includes:

- 1,000 sq. ft. of mesa oak trees and silver buffaloberry shrubs (very low water use plants) irrigated by drip lines
- 6,000 sq. ft. of western redbud trees, and manzanita bushes (low water use plants) irrigated by bubblers
- 2,000 sq. ft. of New Zealand flax (moderate water use plant) irrigated by bubblers
- 500 sq. ft. planted with white alder trees and dahlias (high water use plants) irrigated by pop-up spray heads
- 500 sq. ft. planted with white alder trees and marmalade bush (high water use plants) irrigated by pop-up spray heads

Step No. 1 – Calculate the Maximum Applied Water Allowance (MAWA)

The MAWA is calculated in Section A of the Water Efficient Landscape Worksheet. Use the following formula to calculate MAWA, and show your calculations in the space provided at the bottom of Section A.

$$\text{MAWA} = (\text{ETo}) (0.62) [(0.7 \times \text{LA}) + (0.3 \times \text{SLA})]$$

$$\text{Eto} = 57.33 \text{ inches per year}$$

$$\text{LA} = 10,000\text{-square feet}$$

$$\text{SLA} = 0$$

$$\text{MAWA} = (57.33) (0.62) [(0.7 \times 10,000) + (0.3 \times 0)]$$

$$\text{MAWA} = (57.33) (0.62) [(7,000) + 0]$$

$$\text{MAWA} = (57.33) (0.62) (7,000)$$

$$\text{MAWA} = 248,812 \text{ gallons per year}$$

Step No. 2 – Fill out the Hydrozone Information Table

The Hydrozone Information Table is Section B of the Water Efficient Landscape Worksheet. Instructions for filling out the table are provided as endnotes at the bottom of the table. Use as many tables as necessary to list all areas of the landscape project.

Water Efficient Landscape Worksheet - Section B -Hydrozone Information Table								
Point of Connection Number: 1								
Hydrozone Designator	Controller #	Valve #	Irrigation Method	% Total LA	PF	HA	IE	(PF*HA) / IE
Very Low	1	A	D	10%	.10	1,000	.80	125
Low	1	B	B	60%	.30	6,000	.80	2,250
Moderate	1	C	B	20%	.50	2,000	.80	1,250
High	1	D	S	5%	.80	500	.55	727
High	1	E	S	5%	.80	500	.55	727
Special Landscape Areas* (SLA)								
					N/A		N/A	
					N/A		N/A	
					N/A		N/A	
					N/A		N/A	
Summary Totals:				100%		10,000		5,079
Instructions and Endnotes:								
All landscaped areas in the project must be listed. Use a separate table or set of tables for each point of connection to the water main. Use as many tables as necessary to list all hydrozones in the landscape.								
All designations listed in the table must be consistent with designations shown on the landscape and irrigation plans. Each hydrozone must be listed as a separate record in the table and must be supplied by it's own valve, or set of valves with the same irrigation schedule.								
The abbreviations listed in the table have the following meanings: HA = hydrozone area, IE = irrigation efficiency, LA = landscape area, PF = plant factor								
Use the following abbreviations to indicate the irrigation method: MS = micro-spray, S = spay, R = rotor, B = bubbler, D = drip								
Use the following numbers to indicate the irrigation efficiency (IE) for the irrigation method proposed: MS = 0.80, S = 0.55, R= 0.70, B = 0.80, D = 0.80								
The plant factor listed shall be the plant factor for the highest water use plant in the hydrozone. Plant factor data shall be from WUCOLS and the values shall be listed as follows in the hydrozone information table: High = 0.80, Moderate = 0.50, Low = 0.30, Very Low = 0.10								
Perform the calculation indicated at the top of the final column for each row in the table and list the result for each row in the final column. Add the results listed in the final column together and enter the cumulative value at the bottom of the final column in the row labeled "Summary Totals." This cumulative value shall be used in the formula for determining ETWU as indicated in Section C of the Water Efficient Landscape Worksheet.								
*Note that hydrozones in special landscaped areas utilize a simplified calculation resulting from the additional ETAF allowance for special landscaped areas. For hydrozones in special landscape areas, simply list the hydrozone area in the "HA" column of the table and then list the same number again in the final column of the table.								

Step No. 3 – Calculate the Estimated Total Water Use (ETWU)

The project's ETWU is calculated in Section C of the Water Efficient Landscape Worksheet. ETWU is calculated by multiplying the reference evapotranspiration rate by the conversion factor of 0.62, and also by the number listed at the bottom of the final column of the Hydrozone Information Table. The conversion factor of 0.62 is used to express ETWU in gallons per year.

ETWU = (ET₀) (0.62) (total from final column of Hydrozone Information Table)

ETWU = (57.33) (0.62) (5,079)

ETWU = 180,531 gallons per year

The project's estimated total water use (ETWU) does not exceed the project's maximum applied water allowance (MAWA.) Therefore, the proposed landscape project meets the water efficiency criteria established in Chapter 17.195 of the Zoning Ordinance.

Example Two: This example is based upon a hypothetical landscape project located in El Cajon, CA, consisting of 12,500 sq. ft. of irrigated landscaping at a new multi-family development. Unlike the last example, this example includes landscape areas that mix plants of different water use characteristics within the same area [see Section 17.195.260(B)(4)] It also includes a special landscape area with 500 sq. ft. of edible plants, and it includes a swimming pool and hot tub with a combined surface area of 1,000 sq. ft.

As indicated in Chapter 17.195, when plants of different water use categories are mixed within a hydrozone, the entire hydrozone is considered to be in the water use category of the highest water use plant within the hydrozone. Also keep in mind that plants within a special landscaped area are permitted to use a modified ETAF. This modification results in a simplified calculation in the Hydrozone Information Table for special landscaped areas.

This example includes 6 irrigation circuits controlled by a single programmable irrigation controller. The pool and hot tub are not on a programmable timer. Rather, the water is supplied via a valve that is actuated by a decrease in the water level of the pool. The water is delivered via a pipe located in the side of the pool, below the water line. Therefore, the irrigation efficiency for the pool and spa may be listed as 100%. The pool and spa are considered to be high water use areas when listing the plant factor and the pool's hydrozone. There are no other water features or special landscaped areas in this example.

The landscape area in this example includes:

- 1,000 sq. ft. of mesa oak trees (very low water use plants) and manzanita bushes (low water use plant) irrigated by drip lines
- 6,000 sq. ft of western redbud trees, African sumac trees, and purple sage bushes (low water use plants) irrigated by bubblers
- 2,000 sq. ft. of New Zealand flax (moderate water use plant) mixed with prostrate rosemary (low water use plant) irrigated by micro-spray emitters
- 500 sq .ft planted with white alder trees, turf grass, and dahlias (high water use plants) irrigated by pop-up spray heads
- 1,500 sq. ft. turf play area (high water use plant) irrigated by pop-up spray heads
- 500 sq .ft community vegetable garden (high water use plants – special landscape area) irrigated by spray heads on risers
- A pool and hot tub with a combined surface area of 1,000-sq. ft. which is designated as a high water use area and which includes a water supply system with 100% irrigation efficiency

Step No. 1 – Calculate the Maximum Applied Water Allowance (MAWA)

The MAWA is calculated in Section A of the Water Efficient Landscape Worksheet. Use the following formula to calculate MAWA, and show your calculations in the space provided at the bottom of Section A.

$$\text{MAWA} = (\text{ETo}) (0.62) [(0.7 \times \text{LA}) + (0.3 \times \text{SLA})]$$

ETo = 57.33 inches per year

LA = 12,500-square feet

SLA = 500

$$\text{MAWA} = (57.33) (0.62) [(0.7 \times 12,500) + (0.3 \times 500)]$$

$$\text{MAWA} = (57.33) (0.62) [(8,750) + (150)]$$

$$\text{MAWA} = (57.33) (0.62) (8,900)$$

MAWA = 316,345 gallons per year

Step No. 2 – Fill out the Hydrozone Information Table

The Hydrozone Information Table is Section B of the Water Efficient Landscape Worksheet. Instructions for filling out the table are provided as endnotes at the bottom of the table. Use as many tables as necessary to list all of the hydrozones in the landscape project area.

Water Efficient Landscape Worksheet - Section B -Hydrozone Information Table								
Point of Connection Number: 1								
Hydrozone Designator	Controller #	Valve #	Irrigation Method	% Total LA	PF	HA	IE	(PF*HA) / IE
Low	1	A	D	7%	.30	1,000	.80	375
Low	1	B	B	42%	.30	6,000	.80	2,250
Moderate	1	C	MS	14%	.50	2,000	.80	1,250
High (Part Turf)	1	D	S	4%	.80	500	.55	727
High (Turf)	1	E	S	22%	.80	1,500	.55	2,181
High (Pool and Spa)	N/A	PS-1	N/A	7%	.80	1,000	1	1,250
Special Landscape Areas* (SLA)								
High	1	F	S	4%	N/A	500	N/A	500
					N/A		N/A	
					N/A		N/A	
					N/A		N/A	
Summary Totals:				100%		12,500		8,533
Instructions and Endnotes:								
All landscaped areas in the project must be listed. Use a separate table or set of tables for each point of connection to the water main. Use as many tables as necessary to list all hydrozones in the landscape.								
All designations listed in the table must be consistent with designations shown on the landscape and irrigation plans. Each hydrozone must be listed as a separate record in the table and must be supplied by it's own valve, or set of valves with the same irrigation schedule.								
The abbreviations listed in the table have the following meanings: HA = hydrozone area, IE = irrigation efficiency, LA = landscape area, PF = plant factor								
Use the following abbreviations to indicate the irrigation method: MS = micro-spray, S = spay, R = rotor, B = bubbler, D = drip								
Use the following numbers to indicate the irrigation efficiency (IE) for the irrigation method proposed: MS = 0.80, S = 0.55, R= 0.70, B = 0.80, D = 0.80								
The plant factor listed shall be the plant factor for the highest water use plant in the hydrozone. Plant factor data shall be from WUCOLS and the values shall be listed as follows in the hydrozone information table: High = 0.80, Moderate = 0.50, Low = 0.30, Very Low = 0.10								
Perform the calculation indicated at the top of the final column for each row in the table and list the result for each row in the final column. Add the results listed in the final column together and enter the cumulative value at the bottom of the final column in the row labeled "Summary Totals." This cumulative value shall be used in the formula for determining ETWU as indicated in Section C of the Water Efficient Landscape Worksheet.								
*Note that hydrozones in special landscaped areas utilize a simplified calculation resulting from the additional ETAF allowance for special landscaped areas. For hydrozones in special landscape areas, simply list the hydrozone area in the "HA" column of the table and then list the same number again in the final column of the table.								

Step No. 3 – Calculate the Estimated Total Water Use (ETWU)

The project's ETWU is calculated in Section C of the Water Efficient Landscape Worksheet. ETWU is calculated by multiplying the reference evapotranspiration rate by the conversion factor of 0.62, and also by the number listed at the bottom of the final column of the Hydrozone Information Table. The conversion factor of 0.62 is used to express ETWU in gallons per year.

ETWU = (ET₀) (0.62) (total from final column of Hydrozone Information Table)

ETWU = (57.33) (0.62) (8,533)

ETWU = 303,302 gallons per year

The project's estimated total water use (ETWU) does not exceed the project's maximum applied water allowance (MAWA.) Therefore, the proposed landscape project meets the water efficiency criteria established in Chapter 17.195 of the Zoning Ordinance.

Section Four: Technical Information

Section Four of the manual provides the reference evapotranspiration rate (ET₀) for El Cajon. This section also provides a listing of drought tolerant, low water use plants that are appropriate for the inland valleys of Southern California, such as the El Cajon Valley.

Reference Evapotranspiration: Reference evapotranspiration (ET₀) is a standardized measurement of environmental parameters that affect the water use of plants. ET₀ is given in inches per year and is an estimate of the ET₀ of a large field of four-inches to seven-inches tall, cool season turf that is well watered. Reference ET₀ is used as the basis of determining the maximum applied water allowance so that regional differences in climate can be accommodated. The reference evapotranspiration rate for El Cajon is 57.33 inches per year. This rate is based upon information from CIMIS Station No. 153, located in Escondido, California.

"Nifty Fifty" drought tolerant plant list: The staff at the Water Conservation Garden at Cuyamaca Community College prepared the list provided below. It contains plants that are well adapted to life in hot and arid environments such as the El Cajon Valley. The list is intended to provide landscape professionals, developers, and property owners with a resource to facilitate the planning and design of water efficient landscapes. However, it should be noted that there is no requirement to use the specific plants listed.

Nifty-50 Plants for Water-Smart Landscapes

These plants have been selected because they are attractive, often available in retail nurseries, non-invasive, easy to maintain, long-term performers, scaled for residential landscapes, and of course, after established - drought tolerant. The plants are listed in descriptive categories such as shrubs, trees, and ground covers. The plant's botanical name is listed first, and the common name is listed second. Plants that are native to California are indicated as such.

Shrubs:

Botanical Name / Common Name

1. *Arctostaphylos* species and hybrids / Manzanita (Native)
2. *Ceanothus* species and hybrids / California Lilac (Native)
3. *Cercis occidentalis* / Western Redbud (Native)
4. *Chamelaucium uncinatum* / Geraldton Waxflower
5. *Cistus* species / Rockrose
6. *Grevillea* species and hybrids / Grevillea
7. *Heteromeles arbutifolia* / Toyon (Native)
8. *Leucophyllum* species / Texas Ranger
9. *Mahonia aquifolium* / Oregon Grape (Native)
10. *Myrtus communis* / Common Myrtle
11. *Rosmarinus officinalis* / Rosemary
12. *Westringia fruticosa* / Coastal Rosemary

Succulents

13. *Aeonium* species / Aeonium
14. *Agave* species and hybrids / Agave
15. *Aloe* species and hybrids / Aloe

16. *Calandrinia grandiflora* / Rock Purslane
17. *Dudleya* species and hybrids / Live Forever (Native)
18. *Echeveria* species and hybrids / Hens-and-Chickens

Vines

19. *Bougainvillea* hybrids / Bougainvillea
20. *Mascagnia macroptera* / Yellow Orchid Vine
21. *Vitis californica* / California Wild Grape (Native)

Groundcover

22. *Ceanothus griseus horizontalis* species and hybrids / Carmel Creeper (Native)
23. *Dymondia margaretae* / Silver Carpet
24. *Lampranthus* species / Ice Plant
25. *Lantana montevidensis* / Trailing Lantana
26. *Rosmarinus officinalis* 'Huntington Carpet' / Huntington Carpet Rosemary
 - *Rosmarinus officinalis* 'Lockwood de Forest' / Lockwood de Forest Rosemary
 - *Rosmarinus officinalis* 'Prostrata' / Prostrate Rosemary
 - *Rosmarinus officinalis* 'Santa Barbara' / Santa Barbara Rosemary
27. *Sedum* species and hybrids / Stonecrop
28. *Thymus pseudolanuginosus* / Woolly Thyme

Ornamental Grasses and Grass-like Plants

- 29. *Cordyline australis* / New Zealand Cabbage Tree
- 30. *Muhlenbergia capillaris* / Pink Muhly Grass
- 31. *Pennisetum setaceum* 'Rubrum' / Red Fountain Grass
- 32. *Phormium tenax* and some species and hybrids / New Zealand Flax

Perennials

- 33. *Anigozanthos* species and hybrids / Kangaroo Paws
- 34. *Encelia californica* / California Sunflower
- 35. *Lavandula* species and hybrids / Lavender
- 36. *Mimulus*, Native species and hybrids / Monkey flower (Native)
- 37. *Penstemon*, Native species / Penstemon
 - *Penstemon heterophyllus* / Foothill Penstemon (Native)
 - *Penstemon parryi* / Parry's Beardtongue (Native)
 - *Penstemon spectabilis* / Showy Penstemon (Native)
- 38. *Salvia* species Sage
 - *Salvia Africana lutea* / Dune Sage
 - *Salvia chamaedryoides* / Gernander Sage
 - *Salvia clevelandii* / Cleveland Sage
 - *Salvia leucantha* / Mexican Bush Sage
 - *Salvia greggii* / Autumn Sage
- 39. *Tagetes*, perennial / Perennial Marigold
 - *Tagetes lemmonii* / Copper Canyon Daisy
 - *Tagetes lucida* / Mexican Tarragon

40. *Verbena peruviana* / Peruvian Verbena

Trees

41. *Arbutus 'Marina'* / Strawberry Tree

42. *Butia capitata* / Pindo Palm

43. *Chitalpa tashkentensis* / Chitalpa (Native)

44. *Geijera parviflora* / Australian Willow

45. *Lagerstroemia indica* / Crape Myrtle

46. *Laurus nobilis* / Sweet Bay

47. *Olea europaea 'Swan Hill'* / Fruitless Olive

48. *Parkinsonia x 'Desert Museum'* / Desert Museum Palo Verde

49. *Pistacia chinensis* / Chinese Pistache

50. *Quercus agrifolia* / Coast Live Oak (Native)