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Tackling Watering Challenges in the Landscape
A Case Study, Will Bailey

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Valley Office Park

Purchased in 2007 by Providence Health Systems, irrigation strategy reduced potable water use by more than 50% helping achieve Gold LEED EB status through the US Green Building Council's certification program.

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Irrigation Strategy

Map and Evaluate Existing Irrigation System

ACCOUNT NAME: Valley Office Park
DATE : 1/22/01 DCVA LOCATION: N sides bldgs. A & D in turf

WATER METER LOCATION:
CONTROLLER TYPE:
CONTROLLER LOCATION: N end courtyard in bed
QUICK COUPLER LOCATIONS:
MASTER VALVE: RAIN SENSORS: CLOCK:

ZONE #	HEAD TYPE	Plant	ZONE LOCATION
1	Rotor	Bed	NE bldg. A
2	1800	Bed	NE parking entry both sides
3	Rotor	Turf	N and NE sides bldg. A
4	Rotor	Bed	E side bldg. A
5	1800	Bed	E side bldgs. A and B
6	1800	Turf	E side bldgs. A and B
7	1800	Bed	SE side of bldg. B
8	Rotor/1800	Bed	SE corner bldg. B and kickout island
9	1800	Bed	Both sides SE entry to parking lot
10	1800	Bed	NE corner of courtyard
11	1800	Bed	NE side by turf center courtyard
12	1800	Bed	NE courtyard S end
13	1800	Bed	S courtyard E half
14	1800	Turf	S courtyard W half
15	1800	Bed	W courtyard S half
16	1800	Bed	W courtyard W half
17	1800	Bed	N courtyard W half
18	1800	Bed	N courtyard E half
19	1800	Bed	W side courtyard behind water flow
20	1800	Turf	Turf middle courtyard
21	Rotor	Turf	Turf west side of bldg. C
22	1800	Bed	S side bldg. C and around daycare
23	Rotor	Turf	S side of bldg. B both side of walk
24	1800	Bed	A and D breezeway
25	Rotor	Turf	N side of bldg. D
26	Rotor	Turf	NW corner bldg. D
27	1800	Bed	Shrubs both sidewalk bldgs. B and C S end
28	1800	Bed	Shrubs between C and D W side courtyard entry
29			
30			
31			
32			
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34			
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36			

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Map and Evaluate Existing Irrigation System

Eliminate Irrigation in Established Areas

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Repair/Replace Broken Heads, Nozzles and Lines

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Understand and Manage Your Total Water Requirement

Tackling Watering Challenges in the Landscape: A Case Study, *Will Bailey, Signature Landscaping*

Calculating Total Water Requirement

The Landscape Coefficient Formula

Evapotranspiration (ET)

A very commonly used term when discussing irrigation or landscape is evapotranspiration (or ET for short).

What is evapotranspiration?
Evapotranspiration is the sum of water lost from the soil surface and plant foliage (evaporation) and water used by plants (transpiration). There are a number of factors that affect evapotranspiration including plant species, weather factors and quality of water available to the plant.

Reference Evapotranspiration (ETo)
A helpful way to quantify weather based data is the calculation of reference evapotranspiration or ET. The best sources for live or real-time ET data are local sources (local weather stations), Cooperative Extension Service, National Weather Service and water purveyors.

The reference ET, commonly called ET(o), is expressed in terms of a depth of water per some unit of time. Example: inches per: day, week, month or year. The following table show ETo (monthly) for Colusa and Santa Monica. (courtesy of CIMIS). As you can see, the ET values change monthly based upon how much water the plant (in this case turf) uses in a month. The hotter the month, the more water the plant will use.

Number	Name	Region
32	Colusa	Sacramento Valley
99	Santa Monica	Los Angeles Basin

Stn	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
32	0.95	1.73	3.42	5.03	6.43	7.62	8.34	7.23	5.35	3.78	1.79	1.0
99	1.79	2.12	3.30	4.49	4.73	5.03	5.40	5.38	3.94	3.40	2.42	2.2

Why is ET important?
Evapotranspiration or reference ETo, is an important reference point for irrigation water use calculations. It represents a specific rate of use in response to local weather conditions.

Example of ET in use.

Problem
Determine the **Plant Water Requirement** for Acacia redolens planted at 15" spacing on center.

Location is a garden setting surrounded on three sides by four story concrete buildings in Los Angeles

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5 Factors Influencing Total Water Requirement

Evapotranspiration ET(o)

Evapotranspiration is the sum of water lost from the soil surface and plant foliage (evaporation) and water used by plants (transpiration).

A helpful way to quantify weather based data is the calculation of reference evapotranspiration or ET(o). The best sources for live or real-time ET data are local sources (local weather stations), Cooperative Extension Service, National Weather Service and water purveyors as expressed in the table below. Values in the table are expressed as inches of water per month.

Number	Name	Region
32	Colusa	Sacramento Valley
99	Santa Monica	Los Angeles Basin

Stn	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
32	0.95	1.73	3.42	5.03	6.43	7.62	8.34	7.23	5.35	3.78	1.79	1.08	52.75
99	1.79	2.12	3.30	4.49	4.73	5.03	5.40	5.38	3.94	3.40	2.42	2.22	44.22

5 Factors Influencing Total Water Requirement

Species Factor K(s)

Species Factor K(s) will vary considerably in their transpiration rates. Values for species factor are available through local sources such as Cooperative Extension Service. Water Use Classification of Landscape Species (WUCOLS) is a good resource.

Because there is such a range of water usage among different plants, the water use is divided into three groups: low, medium and high. This is shown in the table below:

VEGETATION	HIGH	MEDIUM	LOW
Trees	0.90	0.50	0.20
Shrubs	0.70	0.50	0.20
Ground cover	0.90	0.50	0.20
Mixed	0.90	0.50	0.20
Turfgrass	0.80	0.70	0.60

5 Factors Influencing Total Water Requirement

Density Factor K(d)

Landscapes can also vary in density. Leaf surface is often less in newly planted landscape than mature landscapes and will use less water. The total water loss from dense planting most likely will be higher due to the greater total leaf area for the site. We then assign a higher density factor to these areas.

VEGETATION	HIGH	MEDIUM	LOW
Trees	1.30	1.00	0.50
Shrubs	1.10	1.00	0.50
Ground cover	1.10	1.00	0.50
Mixed	1.30	1.10	0.60
Turfgrass	1.00	1.00	0.60

5 Factors Influencing Total Water Requirement

Microclimate Factor K(mc)

The environment may also play a role in landscape water use as well. A medium microclimate area is where buildings, pavement, slopes, shade and reflection do not influence the site. In these conditions K(mc) = 1. A high microclimate conation is where the landscape is surrounded (or affected) by heat-absorbing surfaces, reflecting or high wind conditions. In these cases, K(mc) could be as high as 1.4. A low microclimate is where a planting area is in shade or protected from the wind. This area will have a K(mc) = .5.

VEGETATION	HIGH	MEDIUM	LOW
Trees	1.40	1.00	0.50
Shrubs	1.30	1.00	0.50
Ground cover	1.20	1.00	0.50
Mixed	1.40	1.00	0.50
Turfgrass	1.20	1.00	0.80

5 Factors Influencing Total Water Requirement

Irrigation System Efficiency (IE)

Distribution Uniformity describes an irrigation system's ability to deliver water uniformly over an area. Distribution Uniformity can be determined through an irrigation audit by a landscape irrigation auditor in which catch cans are placed and measured in the landscape. A range of 50% to 80% is typical per the table below.

Rating of Distribution Uniformity (DU)	Excellent %	Very Good %	Good %	Fair %	Poor %
Fixed Spray	75%	65%	55%	50%	40%
Gear Rotors	80%	70%	65%	60%	50%
Impact	80%	70%	65%	60%	50%

Calculating Total Water Requirement

TWR=(Et(o) x K(s) x K(d) x K(mc))/IE

<u>Where</u>

TWR	=	**Total Water Requirement**
Et(o)	=	**Reference Evapotranspiration**
K(s)	=	**Species Factor**
K(d)	=	**Density Factor**
K(mc)	=	**Microclimate Factor**
IE	=	**Irrigation Efficiency**

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Calculating Total Water Requirement

TWR=(Et(o) x K(s) x K(d) x K(mc))/IE

Reference Evapotranspiration Et(o)

Number	Name	Region
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99	1.79	2.12	3.30	4.49	4.73	5.03	5.40	5.38	3.94	3.40	2.42	2.22	44.22

Therefore

TWR=(5.40 in/mo x K(s) x K(d) x K(mc))/IE

Calculating Total Water Requirement

TWR=(Et(o) x K(s) x K(d) x K(mc))/IE

Species Factor K(s)

VEGETATION	HIGH	MEDIUM	LOW
Trees	0.90	0.50	0.20
Shrubs	0.70	0.50	0.20
Ground cover	0.90	0.50	0.20
Mixed	0.90	0.50	0.20
Turfgrass	0.80	0.70	0.60

Therefore

TWR=(5.40 in/mo x .5 x K(d) x K(mc))/IE

Calculating Total Water Requirement

TWR=(Et(o) x K(s) x K(d) x K(mc))/IE

Density Factor K(d)

VEGETATION	HIGH	MEDIUM	LOW
Trees	1.30	1.00	0.50
Shrubs	1.10	1.00	0.50
Ground cover	1.10	1.00	0.50
Mixed	1.30	1.10	0.60
Turfgrass	1.00	1.00	0.60

Therefore

TWR=(5.40 in/mo x .5 x 1.10 x K(mc))/IE

Calculating Total Water Requirement

TWR=(Et(o) x K(s) x K(d) x K(mc))/IE

Microclimate Factor K(mc)

VEGETATION	HIGH	MEDIUM	LOW
Trees	1.40	1.00	0.50
Shrubs	1.30	1.00	0.50
Ground cover	1.20	1.00	0.50
Mixed	1.40	1.00	0.50
Turfgrass	1.20	1.00	0.80

Therefore

TWR=(5.40 in/mo x .5 x 1.10 x 1.30)/IE

Calculating Total Water Requirement

TWR=(Et(o) x K(s) x K(d) x K(mc))/IE

Irrigation Efficiency IE

Rating of Distribution Uniformity (DU)	Excellent %	Very Good %	Good %	Fair %	Poor %
Fixed Spray	75%	65%	55%	50%	40%
Gear Rotors	80%	70%	65%	60%	50%
Impact	80%	70%	65%	60%	50%

Therefore

TWR=(5.40 in/mo x .5 x 1.10 x 1.30)/0.65

Calculating Total Water Requirement

TWR = (5.40 in/mo x .5 x 1.10 x 1.30)/0.65

TWR = 5.94 inches/month

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Other Factors to Consider

Slope

Soil Types

Compaction

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Practical Applications

Group Plants with Similar Species Factors Into Irrigation Zones

Decrease Plant Density to Reduce the Density Factor (and pruning)

Specify or Select for Plants with a Low Species Factor in High Micro-climate Locations

Adjust Irrigation Zone Run Times to Match Need

Evaluate Water Usage Data Relative to the Total Water Requirement

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Additional Resources

Signature Landscape Services, Inc.
www.signaturels.com

University of California Cooperative Extension WUCOLS
http://www.water.ca.gov/wateruseefficiency/docs/wucols00.pdf

Atomic Irrigation
www.atomicirrigation.com

US Green Building Council LEED Program
www.usgbc.org

Thank you!