

2025 NATIONAL CONFERENCE | SAVANNAH, GEORGIA

California's Model Water Efficient Landscape Ordinance: What works, what doesn't work, and challenges for the future



Model Water Efficient Landscape Ordinance (MWELO)

<u>History</u>

- In 1990, AB 325 created the Water Conservation in Landscaping Act requiring the Department of Water Resources (DWR) to develop a Model Water Efficient Landscape Ordinance (MWELO).
- In 1993, MWELO was adopted and required all local agencies to adopt a water efficient landscape.
- In 2006, AB 1881 required DWR to update the MWELO.
- In 2010, the updated MWELO went into effect.
- In late 2015, updated MWELO went into effect in response to Governor's mandate during 2012 2016 drought.
- In 2018, Governor approved AB 2371 Landscape Water Use Efficiency:
 - Requiring DWR to update MWELO every 3 years
 - Requiring DWR to "consider" revising the Water Use Classification of Landscape Species (WUCOLS)
 publication
- In 2025, MWELO update was implemented.
- Since inception: 35 years!!!!



Model Water Efficient Landscape Ordinance (MWELO) <u>Purpose</u>

- The State Legislature has found that the waters of the state are of limited supply and are subject to ever increasing demands.
- The continuation of California's economic prosperity is dependent on the availability of adequate supplies of water for future uses.
- Landscapes are essential to the quality of life in California by providing areas for active and passive recreation.
- To use water efficiently without waste by setting a Maximum Applied Water Allowance (MAWA) as an upper limit for water use and reduce water use to the lowest practical amount.



California MWELO = Irrigation Association Terminology

Performance Approach = Landscape Water Budget

Maximum Applied Water Allowance (MAWA) = Upper Boundary (UB)

Estimated Total Water Use (ETWU) = Lower Boundary (LB)

Irrigation Efficiency (IE) = Distribution Uniformity (DU)

Evapotranspiration Adjustment Factor (ETAF) = Landscape Coefficient (KL)

Water Use Classification Of Landscape Species (WUCOLS) = Plant Factor (PF)



California MWELO versus Irrigation Association Equation







MWELO Performance Approach: How does it work?

Maximum Applied Water Allowance (MAWA) > Estimated Total Water Use (ETWU)



CIMIS Historical Monthly **ETo** Values (inches), Davis

Stn Id	Stn Name	CIMIS Region	Jan (in)	Feb (in)	Mar (in)	Apr (in)	May (in)	Jun (in)	Jul (in)	Aug (in)	Sep (in)	Oct (in)	Nov (in)	Dec (in)	Total (in)
6	Davis	SAV	1.32	2.12	3.69	5.50	7.26	8.23	8.35	7.37	5.72	4.16	2.06	1.25	57.03

<u>CIMIS</u> website: https://cimis.water.ca.gov



SmartLandscape @ UC Davis









Western Center for Agricultural Equipment



Conceptual Design, January 2019



Construction, June 2019



June 2023



What problems are SmartLandscape trying to address?

- Can urban landscape demonstration projects be designed, installed, managed and maintained by undergraduate student teams to meet MWELO?
- Can MWELO compliance be validated by measuring the Actual Water Applied (AWA) to landscape projects compared to the calculated Estimated Total Water Used (ETWU)?
- What are the challenges associated with landscapes designed to meet MWELO?



Select YTD Accomplishments





Organizational Design SmartLandscape Student Teams









California Center for Urban Horticulture

SmartLandscape Industry Partners





What strategy should be used for irrigating landscape plants?

- Irrigation should occur based on plant response to environmental demand = Evapotranspiration (ET). ET for specific CA regions is provided by DWR CA Irrigation Management Information System (CIMIS) website.
- 2. Irrigation frequency and amount will be defined by the environmental demand, soil waterholding capacity, plant root zone depth, and slope.
- 3. Irrigation should be applied such that the soil water reservoir is filled, and gravity drainage and runoff do not occur.
- 4. Thus, replacing water lost through ET after triggering of an irrigation event, typically 40-50% Management Allowable Depletion (MAD).







SmartLawn Overview



SmartLawn Conceptual Design







SmartLawn Plot Configuration

1 Turf Alternative	3 Buffalograss	⁵ Cool Season	7 Cool Season	⁹ Cool Season	¹¹ Cool Season
Sub-surface	Sub-surface	Sub-surface	Sub-surface	Sub-surface	Sub-surface
2			· · · · · · · · · · · · · · · · · · ·		
Turf Alternative	Buffalograss	⁶ Cool Season	⁸ Cool Season	¹⁰ Cool Season	¹² Cool Season
Rotator Nozzles	Rotator Nozzles	Rotator Nozzles	Rotator Nozzles	Rotator Nozzles	Rotator Nozzles



Sub-surface (Eco-Mat) and Surface Irrigation (MP Rotator Nozzles)

Verde Plugs





Cool Season Turf Installation

Eco-Mat Temporary Irrigation System



SmartLawn Surface Irrigation



Rotator Nozzle

Rotator Nozzle Advantages

- Increases in distribution uniformity
- Generates a water stream reducing the water lost to atmosphere (evaporation)
- Less runoff occurs for clay soils due to lower precipitation rate (inches water/hour)
- Improves low water pressure



Spray Nozzle







SmartLandscape Premise – Measure Applied Water



Lord Kelvin - "To measure is to know. "If you can not measure it, you can not improve it."

- MWELO is a design standard and "not" a performance standard.
- ETWU is an "ESTIMATE".
- Installed flow meters in each landscape project accurately measures applied water (not estimated, ETWU, as per MWELO).





Sub-surface and Surface Irrigated Warm Season UC Verde Buffalograss Results



UC Verde Water Budget Calculation Applied Water (gallons) Compared to MAWA and ETWU

Maximum Applied Water Allowance (MAWA) > Estimated Total Water Use (ETWU)



Sub-Surface UC Verde: 2022-2024



UC Verde Water Budget Calculation Applied Water (gallons) Compared to MAWA and ETWU

Maximum Applied Water Allowance (MAWA) > Estimated Total Water Use (ETWU)



Surface UC Verde: 2022-2024



UC Verde Buffalograss: Actual Plant Factor Calculation Using Applied Water

Maximum Applied Water Allowance (MAWA) > Estimated Total Water Use (ETWU)

Step 1: | ETWU = (ETo) (0.62) (PF*LA)/IE

- Step 2: Re-arrange ETWU equation to "solve" for Actual Plant Factor
- Step 3: Actual PF = (AWA) x (IE)/(ETo) x (0.62) x (LA)

Step 4: Plug in AWA and solve for Actual PF

Plot	AWA	Act. PF	WUCOLS PF
Sub-surface	3,442	0.31	0.60
Surface	3,159	0.28	0.60





Sub-surface and Surface Irrigated Cool Season Turfgrass Results



Cool Season Turf Water Budget Calculation Applied Water (gallons) Compared to MAWA and ETWU

Sub-Surface Cool Season: 2022-2024

Maximum Applied Water Allowance (MAWA)

Estimated Total Water Use (ETWU)



Year



Cool Season Turf Water Budget Calculation Applied Water (gallons) Compared to MAWA and ETWU

Maximum Applied Water Allowance (MAWA)

Estimated Total Water Use (ETWU)





Cool Season Turfgrass: Actual Plant Factor Calculation Using Applied Water

Maximum Applied Water Allowance (MAWA) > Estimated Total Water Use (ETWU)

Step 1: | ETWU = (ETo) (0.62) (PF*LA)/IE

- Step 2: Re-arrange ETWU equation to "solve" for Actual Plant Factor
- Step 3:Actual PF = (AWA) x (IE)/(ETo) x (0.62) x (LA)Step 4:Plug in AWA and solve for Actual PF

PLOT	AWA	Act. PF	WUCOLS PF
Sub-surface	5,573	0.50	0.80
Surface	7,603	0.68	0.80





SmartScape Overview



SmartScape I: 2023 MWELO Water Budget Calculation for North, South and Trees





<u>Note</u>:

- H1: Mixed Shrub Landscape
- H2: Mixed Shrub Landscape
- H3: Trees

Landscape Parameters

- Low water use non-natives and native cultivars
- Buried fleeced wrapped Inline drip (Eco-Wrap)
- Hydrawise controller
- Weather-based controlled
- Hunter RZWS (trees)
- WUCOLS Plant Factor = 0.3
- Flow meter installed









SmartScape I:

Applied Water (gallons) Compared to MAWA and ETWU

Maximum Applied Water Allowance (MAWA) > Estimated Total Water Use (ETWU)

SmartScape I: 2021-2024





SmartScape I: Actual Plant Factor Calculation Using Applied Water

Maximum Applied Water Allowance (MAWA) > Estimated Total Water Use (ETWU)

Step 1: ETWU = (ETo) (0.62) (PF*LA)/IE

- Step 2: Re-arrange ETWU equation to "solve" for Actual Plant Factor
- Step 3: Actual PF = (AWA) x (IE)/(ETo) x (0.62) x (LA)

Step 4:	Plug in AWA a	nd solve for Actual PF
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YEAR	AWA	Act. PF	WUCOLS PF	
2021	31,370	0.25	0.30	
2022	32,057	0.26	0.30	
2023	23,526	0.19	0.30	
2024	23,554	0.19	0.30	



MWELO Lessons Learned

- 1. What works?
- 2. What doesn't work?
- 3. Opportunities
- 4. Challenges for the future



California MWELO: What Works?

- 1. Low water use landscapes, warm season turfgrass and mixed shrub and trees, can be designed, installed, managed, and maintained to meet MWELO at UC Davis.
- 2. MWELO can serve as a "design standard" for low water use landscapes at UC Davis but does not ensure landscape water savings.
- 3. Current irrigation technology (i.e., sub-surface irrigation and smart controller) can be used to manage low water use plants for compliance.
- 4. The Evapotranspiration Adjustment Factor (ETAF) and Plant Factor (PF) will determine the irrigation management = gallons
- 5. Plants do "not" save water! It is the person managing the irrigation controller determines water savings!



California MWELO: What Doesn't Work?

- 1. MWELO is a "design and not a performance" standard. Unless there you measure and monitor actual water applied, you will not validate compliance.
- 2. Landscape professionals are challenged to measure and monitor actual water applied and have limited resources to analyze data for compliance on a site-by-site basis.
- 3. Once a landscape documentation is approved by the local planning department, the landscape design is provided to the landscape contractor. There is no audit post-installation to ensure compliance to the landscape design.
- 4. Meeting MWELO is complicated and requires significant horticultural education and utilization of professional resources.



California MWELO: What Doesn't Work?

- 5. SmartScape landscapes at UC Davis has been MWELO compliant since installation (3 to 4 years), however results cannot be extrapolated to all California climate regions due to the following differences:
 - A. Environmental (temperature, wind, precipitation, solar radiation, ETo, etc.)
 - B. Soil type (sandy, silty, clay, with various permutations)
 - C. Soil properties (infiltration rate, water holding capacity, air-filled porosity, etc.)
 - D. Landscape nuances (slope, bioswale, plant density, micro-climates, sun/shade exposure)
 - E. All plants, whether low-water use or native, are "not the same".



What Doesn't Work: Distribution Uniformity (DU)?

MWELO Performance Approach

Maximum Applied Water Allowance (MAWA) > Estimated Total Water Use (ETWU)

MAWA = (ETo) (ETAF) (LA) (0.62)MAWA = Maximum Applied Water Allowance
ETo = Reference Evapotranspiration (from CIMIS)
ETAF = Evapotranspiration Adjustment Factor (0.45 or 0.55)
LA = Landscape Area (square feet)
0.62 = Conversion factor (to gallons)MAWA = Maximum Applied Water Allowance
ETo = Reference Evapotranspiration (from CIMIS)
PF = Plant Factor (from WUCOLS)
LA = Landscape Area (square feet)
0.62 = Conversion factor (to gallons)MAWA = Maximum Applied Water Allowance
ETO = Reference Evapotranspiration (from CIMIS)
PF = Plant Factor (from WUCOLS)
LA = Landscape Area (square feet)
0.62 = Conversion factor (to gallons)

- IE = Distribution Uniformity (DU) X Irrigation Management Efficiency (IME)
- As per MWELO, IE = 0.75 and IME = 0.90
- Therefore, solving for DU = IE/IME
- DU as per MWELO = 0.83



What Doesn't Work: Distribution Uniformity (DU)

Note: MWELO DU = 0.83 for surface irrigation

From Predicting and Estimating Landscape Water Use (2001)

Sprinklers

Table 5-3: Estimated Sprinkler DU

	Excellent	Very Good	Good	Fair	Poor
Fixed Spray	0.75	0.65	0.55	0.50	0.40
Rotor	0.80	0.70	0.65	0.60	0.50
Stream Rotor	0.85	0.80	0.75	0.65	0.55
Impact	0.80	0.70	0.65	0.60	0.50

UC Evapotranspiration Adjustment Factor Study (2014 - 2016)

Location	Initial	Final	%	Initial	Final
Location	D.U. %	D.U. %	increase	P.R.	Р.К.
1	34	63	29	1.12	0.36
2	67	69	2	0.59	0.60
3	43	68	25	0.33	0.36
4	60	67	7	1.55	0.62
5	40	62	22	1.10	1.00
6	44	64	20	1.60	0.40
7	56	67	11	2.02	0.70
8	54	70	16	0.62	0.56
9	73	70	-3	0.71	0.53
10	56	77	21	0.82	0.87
11	76	79	3	0.37	0.40
12	58	70	12	0.90	1.04
13	69	60	-9	0.71	0.59
14	40	71	31	1.17	0.90
AVERAGE=	55	68			

- What is the MWELO requirement for DU?
- DU = 0.83 as per MWELO
- Is(0.83)DU realistic?



What Doesn't Work? Irrigation Efficiency (IE)

MWELO Performance Approach

Maximum Applied Water Allowance (MAWA) > Estimated Total Water Use (ETWU)



- (IE = Distribution Uniformity (DU) X Irrigation Management Efficiency (IME)
- (IME)= 0.90 and DU = 0.83 currently under MWELO

Therefore, IE = 0.83 (DU surface irrigation) x 0.90 (IME) = 0.75

Is 0.75 realistic?



What Doesn't Work? Irrigation Management Efficiency (IME)

From Predicting and Estimating Landscape Water Use (2001)

Table 5-16: Management EfficienciesExcellent0.95Very Good0.90Good0.85Fair0.80

→ IME = 0.90 in MWELO

- (IE)= 0.75 and (DU)= 0.83 for surface irrigation in MWELO
- Re-arrange formula IE = DU X IME to solve for IME
- IME = IE/DU = 0.75/0.83 = 0.90
 - From 2013 2015, the CCUH conducted 30+ Irrigation

Management workshops for irrigation professionals and

estimated the participant IME = 40-50%. Our workshop

instructor had an IME = 90%+.

For MWELO, is an IME = 0.90 realistic?

What Doesn't Work? Effective Precipitation (Eppt)

MWELO Without Effective PrecipitationMWELO With Effective PrecipitationMAWA = (ETo) (ETAF) (LA) (0.62)MAWA = (ETo - Eppt) (ETAF) (LA) (0.62)ETo = Reference Evapotranspiration (inches per year)MAWA = (ETo - Eppt) (ETAF) (LA) (0.62)0.45 or 0.55 = Evapotranspiration Adjustment FactorETo = Reference Evapotranspiration (inches per year)0.45 or 0.55 = Evapotranspiration Adjustment Factor0.55 = Evapotranspiration Adjustment FactorLA = Landscape Area (square feet)0.62 = Conversion factor (to gallons)0.62 = Conversion factor (to gallons)0.62 = Conversion factor (to gallons)

- Currently, Effective Precipitation (Eppt), is optional and most cities, districts and counties in California do not include it.
- If Eppt is included in MAWA, 25% of the annual precipitation is subtracted from MAWA.
- For SmartScape I, including Eppt reduces MAWA approximately 10%



Opportunities and the Future

California has MWELO, so be prepared that MWELO can move "west"! TX, AZ, WA, GA, NY, NV, NH, CO, MN



The Alliance for Water Efficiency's 2022 U.S. State Policy Scorecard for Water Efficiency and Sustainability (Scorecard) 2022 State Policy Scorecard for Water Efficiency and Sustainability - Alliance for Water Efficiency



Opportunities and the Future

- 1. California has MWELO, so be prepared that MWELO can move "west"! AZ, MT, UT, TX, FL to name a few?
- 2. The ETAF in MAWA will set your water budget and for ETWU, the Plant Factor will determine the amount of gallons
- 3. Education, education and more education for irrigation professionals:
 - A. Irrigation management (MWELO Performance Approach) is complicated and challenging to understand (water budget approach, smart controller technology, drip irrigation, etc.)
 - B. How do you annually manage to your water budget MAWA?
 - C. How do I know if my landscapes are in compliance?
 - D. Which irrigation certification program ensures state/local compliance?



Opportunities and the Future

- 4. Regulatory Process:
 - A. Educate yourself on the process:
 - I. What works, what doesn't work?
 - II. Who are the "key" players?
 - **III.** Who makes the decisions?
 - IV. How are decisions made?
 - B. Legislators and agency personnel need to be "consistently" informed on what really happens in the "real world" and why
 - C. Engage in the rule making process: volunteer on agency committees, be active, be professionally proficient, be intentional
 - D. Don't make it a "win-lose" proposition...bottom line, you need to be heard
 - E. And remember, if you aren't at the table, then you're on the menu



Opportunities and the Future (cont.)

- 5. Advocacy: engagement is "key"
 - A. Identify organizations with "shared" interests
 - B. Leadership partnership with other trade organization leadership such as IA, ASIC, APLD, ASLA, CLCA, and NGO's, etc.
 - C. Identify (list, sort, choose) and consensually agree on "top" issues
 - D. Work with PAC's on messaging, strategy and rollout plan
 - E. Message needs to be clear, concise and unified on the same "top" issues between trade organizations, with chapters and between chapters...repetition is "great"!
 - F. Engage state and local legislature and agencies
 - G. Roll out and enforcement of ordinances happen at the local level (in California)
 - H. Don't be like CA! No "earmarked" monies for urban landscape water conservation and water use efficiency



Opportunities and the Future (cont.)

- 6. Recommendations for California on MWELO for the next MWELO update process should begin this year... you need to be "at the table"
 - A. Distribution Uniformity: 0.83 uniformity for surface irrigation
 - B. Distribution Uniformity: 0.90 for surface irrigation, needs to be defined for drip irrigation (point source, single inline, and grid inline)
 - C. Irrigation Management Efficiency: 0.90 competency needs to be revisited, defined, and updated
 - D. Effective Precipitation: for CA it is optional now, but it may be mandatory in next update in 2026
 - E. Performance Approach versus Prescriptive Approach
 - F. ETo Table Appendix C: new update is Spatial CIMIS ETo "only" and the inclusion of using ETo from CIMIS weather stations needs to be added
 - G. Re-evaluate the Plant Factor for warm-season turfgrass





THANK YOU!

QUESTIONS?

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