

WEST KERN WATER DISTRICT

Evaporative Cooler Variance Methodology

FY 2024-2025

SUMMARY	
<p>The California Department of Water Resources recognizes that significant water use of evaporative coolers exists as a unique use of water and will allow suppliers to apply for a variance in this category. In accordance with DWR’s recommended guidelines and methodologies for the significant use of ECs, as outlined in DWR’s “Recommendations for Variance for Significant Water Use of Evaporative Coolers, Methods of Calculation, and Supporting Data Requirements” (WUES-DWR-2021-05)¹</p> <p>West Kern performed an in-house study and analysis of evaporative cooler use by its residential customers to calculate a Variance Efficient Water Use Volume, following the methodology outlined below.</p>	
DWR GUIDANCE	WEST KERN METHODOLOGY PROCESS
Only EC water use at residential properties is allowed under this variance	Residential properties were broken down into billing routes consisting of 28 separate areas. A representative sample of each area was determined using 30% of the total count of active residential lots in each area at a 95% confidence level, and 1.8% margin of error.
Supplier will base its analysis of EC use from information collected from its customers	The District sent a Self-Survey to all its customers requesting the customer to report their use of evaporative coolers in quantity and CFM rating. To date, the District received ~ 495 responses equating to roughly 8% of residential customers. Because the information reported from customers was sporadic, the District began collecting information from the field using drive-by surveys, google earth resources and visual inspection verifications. The drive-by sample survey sites were selected using a random generator within Excel. The number of evaporative coolers for each randomized site was documented.
Variance Efficient Water Use Volume is calculated based on the total number of customers using EC units in a service area, the average evaporation rate, and total number of operation hours per day for EC units	Representative sample counts were used to infer the total count of evaporative coolers in each billing area. The average evaporation rate, and total number of operating hours of designated operating days where ambient air temperature was greater than 78 degrees Fahrenheit, was calculated using CIMIS weather station data for the time period of July 1, 2024 to June 30, 2025. The Excel add-in “PSYCH” was used to calculate the wet bulb temperature from the dry bulb and relative humidity gathered from the Belridge CIMIS Weather Station.

DATA REQUIRED FOR CALCULATIONS AND ANALYSIS

DWR GUIDANCE	WEST KERN METHODOLOGY PROCESS
Hourly weather data	The District used hourly weather data from CIMIS Station 146, Belridge, in the San Joaquin Valley CIMIS Region from July 1, 2024 – June 30, 2025.
EC indicator	The District determined EC use based on customer reported self-survey information and field surveys of randomized sample sites
Air exchange rate in CFM to be reported by customers	<p>The District utilized county records for each property to determine an average sq. footage of homes for each billing area. The District also referenced U.S. Department of Energy’s information on evaporative coolers for air exchanges, which indicates an average of 30 exchanges per hour². Using an average ceiling height of 8 feet, the formula (CFM=TA * CH * (AE/60)) was applied to calculate an average CFM for each area, which was used in the formula.</p> <p>CFM: cubic feet per minute TA: total area of room/house in sf CH: ceiling height AE: air exchanges per hour</p>

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<p>EC evaporation rate (gallons per hour) calculated using <u>CFM x ΔT x efficiency rate</u> 8700</p>	<p>AVG CFM was calculated using the method described above for each separate billing area due to the varying size of homes based on their geographical location and age. ΔT (the difference between dry bulb temperature and wet bulb temperature) was calculated from data reported by the Belridge CIMIS weather station 146 in the San Joaquin region during the time of July 1, 2024 – June 30, 2025. The wet bulb temperature was calculated using the dry bulb temperature and relative humidity reported from CIMIS station, using the PSYCH Excel add-in and the standard atmospheric pressure of 101325 Pa (1atm). Once the wet bulb temperature was determined, the following formula was applied to determine the EC rate in gallons per hour. A representative EC performance efficiency was set at 0.8 (80 percent) where almost 8700 BTU's of heat is required to evaporate 1 gallon of water.</p> <p><u>CFM x ΔT x efficiency rate</u> 8700</p>
<p>Operating days = days where ambient temperature is greater than 78 degrees Fahrenheit</p>	<p>The CIMIS weather station data was used to determine operating days where ambient temperature was greater than 78 degrees Fahrenheit.</p>
<p>Maximum operating hours per operating day</p>	<p>The CIMIS weather station data was used to determine the number of operating hours in the operating day where the ambient temperature was greater than 78 degrees Fahrenheit.</p>
<p>Operating Day Average ΔT (diff in dry bulb and wet bulb temperature)</p>	<p>CIMIS weather station data including dry bulb temperature and relative humidity was used to calculate the wet bulb temperature using the PSYCH Excel add-in. ΔT (the difference between dry bulb temperature and wet bulb temperature) was calculated for each operating hour to determine an Operating Day Average ΔT</p>
<p>Operating Day Average EC Evaporation Rate <u>CFM x Operating Day Average ΔT x efficiency rate</u> 8700</p>	<p>The average EC evaporation rate per hour in gallons per hour was determined using an average CFM (for each billing area) x the operating day AVG ΔT x efficiency rate 0.8 (80 percent) / 8700</p>
<p>Efficient Operating Day EC Customer Water Use = Max Operating Hours per Operating Day x Operating Day Average EC Evaporation Rate (gallons per hour)</p>	<p>The Efficient Operating Day EC Customer Water Use was calculated using the sum of operating hours per operating day x the Operating day Average EC Evaporation Rate (in gallons per hour)</p>
<p>Variance Efficient Water Use Volume Calculation is summed up for all operating days and all customers with ECs</p>	<p>The Variance Efficient Water Use Volume was calculated using the total count of active residential lots with ECs x the Efficient Operating Day EC Customer Water Use x the total number of operating days</p>

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References:

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Recommendations for Variance for Significant Water Use of Evaporative Coolers, Methods of Calculation, and Supporting Data Requirements. Retrieved July 1, 2024, from https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Water-Use-And-Efficiency/2018-Water-Conservation-Legislation/Performance-Measures/VAR_EC_WUES-DWR-2021-05_COMPLETE.pdf

²

Evaporative Coolers (U.S. Department of Energy, Ed.) [Review of *Evaporative Coolers*]. Energy.Gov. Retrieved September 23, 2024, from <https://www.energy.gov/energysaver/evaporative-coolers>