



**Technical Memorandum:**  
**Estimation of Evaporative Cooler Water Use – Mission Springs Water District**

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Prepared by: Mission Springs Water District

Subject: Technical Methodology for Estimating Residential Evaporative Cooler Water Use

## **1. Purpose**

This memorandum documents the methodology used by Mission Springs Water District (MSWD) to estimate residential evaporative cooler (EC) water use within the District's service area. The purpose is to provide a rigorous, technically defensible, and transparent estimate in support of a variance request under the *Making Conservation a Way of California Life* regulation.

The methodology integrates local service data, State-recognized modeling tools, psychrometric calculations, and conservative engineering assumptions to produce an estimate of EC water use that reflects realistic operating conditions while avoiding overestimation.

## **2. Overview of Methodology**

The District's approach combines four primary data sources and modeling frameworks:

1. Service Connections: Authoritative counts of residential water service connections maintained by MSWD.
2. Residential Appliance Saturation Survey (RASS) 2019: Provides EC adoption rates in Southern California Edison (SCE) territory, used to estimate the number of residential units with ECs.
3. California Irrigation Management Information System (CIMIS) Hourly Weather Data: Provides dry-bulb and wet-bulb temperatures for FY 2025 from the Indio 2 station (ID 200).
4. California Department of Water Resources (DWR) Evaporative Cooler Water Use Tool (Excel): Calculates EC water use using psychrometric relationships, hourly weather data, airflow (CFM), and system efficiency.

The key output is total annual water use in gallons, which can be converted to acre-feet for water planning purposes.



### **3. Estimation of Evaporative Cooler Population**

#### **3.1 Residential Connections**

MSWD maintains accurate records of residential water service connections. For the FY 2025 calculation, the District reported 13,474 residential connections. Using service connection counts as the denominator provides a precise basis for estimating the EC population because it reflects actual households receiving water, avoiding the potential inaccuracies of census-based or assessor-based estimates.

#### **3.2 Application of RASS Data**

The 2019 RASS indicates that 12.8% of households within the SCE service territory have an evaporative cooler. MSWD applies this saturation rate to its service connections to estimate the number of ECs:

$$\text{Number of ECs} = 13,474 \times 0.128 = 1,724 \text{ units}$$

This approach is intentionally conservative:

- The RASS saturation rate covers a broad utility territory and may understate EC prevalence in MSWD's service area given the arid climate of Desert Hot Springs, CA.
- No adjustments were made for multifamily dwellings or housing types less likely to have ECs, ensuring potential EC counts are not overestimated.

### **4. Estimation of Operating Hours**

#### **4.1 Weather-Based Analysis**

Operating hours are determined using hourly CIMIS data. ECs are assumed to operate when outdoor dry-bulb temperature exceeds 78°F, consistent with standard psychrometric criteria for effective evaporative cooling. Relative humidity was not used as a limiting factor because the Coachella Valley desert climate rarely exceeds the humidity threshold that significantly impairs evaporative cooling efficiency.

For FY 2025, CIMIS Indio 2 data indicate 257 operating days per year. Average daily operating hours were calculated at 15.4 hours/day, based on hourly temperature data.

#### **4.2 Cross-Check via Energy-Based Estimation**

As a validation, the 2019 RASS reports unit energy consumption (UEC) of 890 kWh/year for households with ECs. Assuming a fan power draw of 0.5 kW:



$$\text{Operating Hours/year} = \frac{890 \text{ kWh}}{0.5 \text{ kW}} \approx 1,780 \text{ hours/year}$$

The weather-based calculation using CIMIS data identifies 257 days with temperatures exceeding 78°F and an average of 15.4 hours/day above this threshold (~3,958 hours/year). Accounting for intermittent fan operation, cycling, and system efficiency (0.8), the effective operating hours are consistent with the energy-based estimate of ~1,780 hours/year. This cross-check provides confidence that the weather-based methodology does not underestimate actual EC operation.

## 5. Airflow (CFM) Assumptions

### 5.1 Technical Basis

Airflow is a key determinant of EC water use. Residential ECs are commonly rated between 4,000–7,500 CFM depending on home size, ceiling height, and design. Standard engineering sizing for whole-house evaporative coolers follows:

$$\text{CFM} = \frac{\text{Home Area (ft}^2\text{)} \times \text{Ceiling Height (ft)}}{2}$$

Note for improvement:  
use citation from sources

For example, a 1,500–1,800 ft<sup>2</sup> home with 8-ft ceilings would require approximately 6,000–7,200 CFM:

$$\begin{aligned}\text{CFM} &= \frac{1,500 \times 8}{2} = 6,000 \text{ CFM} \\ \text{CFM} &= \frac{1,800 \times 8}{2} = 7,200 \text{ CFM}\end{aligned}$$

### 5.2 Conservative Baseline

To avoid overestimating water demand, MSWD adopted a 4,000 CFM baseline per unit, which is below typical sizing guidelines and manufacturer ratings. This conservative assumption ensures that water use estimates are lower-bound and defensible.

## 6. Water Use per Unit

Water use per unit is calculated using both the DWR Evaporative Cooler Water Use Tool and the DWR Variance Request template. The Variance Request template computes EC water use as:

$$\text{Water Use} = \text{Number of Evaporative Coolers (Nec)} \times \text{Average Daily Operating Hours (Ho)} \times \text{Evaporative Rate (Rec)} \times \text{Number of Operating Days (Ndays)}$$



Inputs for MSWD:

Parameter	Value
Number of Evaporative Coolers (Nec)	1,724
Average Daily Operating Hours (Ho)	15.42
Evaporative Rate (Rec)	9.15862069 gallons/hour
Operating Days	257
Average Airflow per Unit (CFM)	4,000
Average Daily $\Delta$ Humidity ( $^{\circ}$ F)	24.9
Efficiency Factor	0.8
Unit Conversion Factor (State)	8,700

Applying the State template formula produces an estimated total annual water use of 62,572,691 gallons.

## 7. Sensitivity Analysis

Alternative sizing scenarios were evaluated to ensure robustness:

The adopted 4,000 CFM baseline (~10,000 gal/unit) is conservative relative to these ranges.

Home Area (ft <sup>2</sup> )	CFM	gph	Annual Water Use (gal/unit)
1,200	4,800	6.7	11,962
1,500	6,000	8.4	14,952
1,800	7,200	10	17,942
2,000	8,000	11	19,936



## 8. Technical Justification

- CFM Selection: Below manufacturer-recommended sizing and standard engineering calculations.
- Operating Hours: Derived from hourly CIMIS data, validated against RASS energy use.
- Water Use Calculation: Based on DWR-recognized psychrometric methodology.
- Conservatism: All assumptions are intentionally conservative to ensure the District does not overestimate potential water use.

## 9. Sources

1. California Department of Water Resources. *Evaporative Cooler Water Use Tool and Methodology*. DWR Tool
2. California Irrigation Management Information System (CIMIS). FY 2025 Indio 2 station (ID 200) hourly weather data. <https://cimis.water.ca.gov/WSNReportCriteria.aspx>
3. California Energy Commission. 2019 Residential Appliance Saturation Survey (RASS). <https://www.energy.ca.gov/data-reports/surveys/2019-residential-appliance-saturation-study>
4. Building America Solution Center. *Evaporative Cooling Systems Design and Sizing Guidelines*. <https://basc.pnnl.gov/resource-guides/evaporative-cooling-systems>
5. Manufacturer Specifications (Lennox, Honeywell, or other residential evaporative cooler manufacturers).