



## SECTION B. WATER BUDGET CALCULATIONS

Example calculations are provided in Section C.

### **Section B.1. Maximum Applied Water Allowance (MAWA)**

The project's Maximum Applied Water Allowance shall be calculated using this equation:

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

where:

MAWA = Maximum Applied Water Allowance (gallons per year)

ETo = Reference Evapotranspiration for City of Davis (annual ETo in inches per year)

0.7 = ET Adjustment Factor (ETAF)

LA = Landscaped Area includes Special Landscape Area (square feet)

0.62 = Conversion factor (to gallons per square foot)

SLA = Portion of the landscape area identified as Special Landscape Area (square feet)

0.3 = The additional ET Adjustment Factor for Special Landscape Area (1.0 - 0.7 = 0.3)

Reference Evapotranspiration (ETo) Table for City of Davis

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual ETo
1.0	1.9	3.3	5.0	6.4	7.6	8.2	7.1	5.4	4.0	1.8	1.0	52.5

**Maximum Applied Water Allowance = \_\_\_\_\_ gallons per year**

Show calculations.

Effective Precipitation (Eppt)

*If considering Effective Precipitation, use 25% of annual precipitation. Use the following equation to calculate Maximum Applied Water Allowance:*

$$\text{MAWA} = (52.5 - \text{Eppt}) (0.62) [(0.7 \times \text{LA}) + (0.3 \times \text{SLA})]$$

**Maximum Applied Water Allowance = \_\_\_\_\_ gallons per year**

Show calculations.

**Section B.2. Estimated Total Water Use (ETWU)**

The project’s Estimated Total Water Use is calculated using the following formula:

$$ETWU = (ETo)(0.62)\left(\frac{PF \times HA}{IE} + SLA\right)$$

where:

- ETWU = Estimated total water use per year (gallons per year)
- ETo = Reference Evapotranspiration for City of Davis (annual ETo in inches per year)
- PF = Plant Factor from WUCOLS (see Definitions)\*
- HA = Hydrozone Area [high, medium, and low water use areas] (square feet)\*
- SLA = Special Landscape Area (square feet)
- 0.62 = Conversion Factor (to gallons per square foot)
- IE = Irrigation Efficiency (minimum 0.71)

*\*PF x HA amount used in the formula is the sum amount of the individual Plant Factor (PF) and respective Hydrozone Area (HA) calculations.*

**Hydrozone Table for Calculating ETWU**

Please complete the hydrozone table(s). Use as many tables as necessary.

Hydrozone	Plant Water Use Types(s)	Plant Factor (PF)*	Hydrozone Area (HA) (square feet)	PF x HA (square feet)
<b>Sum</b>	<b>N/A</b>	<b>N/A</b>		
	<b>SLA</b>			

**Estimated Total Water Use = \_\_\_\_\_ gallons**

Show calculations.

## SECTION C. EXAMPLE WATER BUDGET CALCULATIONS

The example calculations below for the Maximum Applied Water Allowance (MAWA) and the Estimated Total Water Use (ETWU) are hypothetical to demonstrate proper use of the equations and do not represent an existing and/or planned landscape project. The ETo values used in these calculations are from the Reference Evapotranspiration Table for the City of Davis, for planning purposes only. For actual irrigation scheduling, automatic irrigation controllers are required and shall use current reference evapotranspiration data, such as from the California Irrigation Management Information System (CIMIS), other equivalent data, or soil moisture sensor data.

### **EXAMPLE 1. Landscape Project with No Special Landscape Areas**

A hypothetical landscape project in Davis, CA with an irrigated landscape area of 50,000 square feet without any Special Landscape Areas (SLA= 0, no edible plants, recreational areas, or use of recycled water).

#### **Step 1. Calculate the Maximum Applied Water Allowance (MAWA).**

To calculate MAWA, the annual reference evapotranspiration value of 52.5 inches for Davis, as listed in the Reference Evapotranspiration Table, is used,

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

MAWA = Maximum Applied Water Allowance (gallons per year)

ETo = Reference Evapotranspiration of 52.5 for City of Davis (annual ETo in inches per year)

0.62 = Conversion Factor (to gallons)

0.7 = ET Adjustment Factor (ETAF)

LA = Landscape Area including SLA (square feet)

0.3 = Additional Water Allowance for SLA

SLA = Special Landscape Area (square feet)

$$\begin{aligned} \text{MAWA} &= (52.5 \text{ inches}) (0.62) [(0.7 \times 50,000 \text{ sq. ft.}) + (0.3 \times 0)] \\ &= (32.55) [35,000 + 0] \end{aligned}$$

$$\text{MAWA} = \mathbf{1,139,250 \text{ gallons per year}}$$

To convert from gallons per year to hundred-cubic-feet per year, divide the amount by 748 (based on the conversion rate of 100 cubic feet = 748 gallons):

$$1,139,250 \text{ gallons per year} / 748 \text{ gallons} = 1,523 \text{ hundred-cubic-feet per year}$$

#### **Step 2. Calculate the Estimated Total Water Use (ETWU).**

The formula for ETWU is shown below. In this example, the landscape area is 50,000 square feet. Plant water use type, plant factor, and hydrozone areas for a hypothetical landscape plan are shown in the table below. The ETo value is 52.5 inches per year. The minimum Irrigation Efficiency (IE) value of 0.71 is used. There are no Special Landscape Areas (recreational area, area permanently and solely dedicated to edible plants, and area irrigated with recycled water).

$$\text{ETWU} = (\text{ETo})(0.62) \left( \frac{\text{PF} \times \text{HA}}{\text{IE}} + \text{SLA} \right)$$

Example Hydrozone Table

Hydrozone	Plant Water Use Types(s)	Plant Factor (PF)*	Hydrozone Area (HA) (square feet)	PF x HA (square feet)
1	High	0.8	7,000	5,600
2	High	0.7	10,000	7,000
3	Medium	0.5	16,000	8,000
4	Low	0.3	7,000	2,100
5	Low	0.2	10,000	2,000
<b>Sum</b>	<b>N/A</b>	<b>N/A</b>	<b>50,000</b>	<b>24,700</b>

\*Plant Factor from WUCOLS

$$ETWU = (52.5)(0.62) \left( \frac{24,700}{0.71} + 0 \right)$$

$$= (32.55) (34,789 + 0)$$

$$ETWU = 1,132,373 \text{ gallons per year}$$

**Step 3. Compare the ETWU Calculation with the MAWA Calculation.**

In this example, the Estimated Total Water Use of 1,132,373 gallons per year is less than the Maximum Applied Water Allowance of 1,139,250 gallons per year. Therefore, the water budget complies with the MAWA.

**EXAMPLE 2. Landscape Project With Special Landscape Area**

This hypothetical landscape project in Davis, CA has the same ETo value of 52.5 inches and a total landscape area of 50,000 square feet, similar to Example 1. However, within the 50,000 square foot project, there is now a 2,000 square foot area planted with edible plants. This 2,000 square foot area is considered to be a Special Landscape Area. The same formulas are used.

**Step 1. Calculate the Maximum Applied Water Allowance (MAWA).**

The same values are used as in Example 1 with the inclusion of the SLA value (2,000 square feet) in this example.

$$MAWA = (ET_o) (0.62) [(0.7 \times LA) + (0.3 \times SLA)]$$

$$\begin{aligned} MAWA &= (52.5 \text{ inches}) (0.62) [(0.7 \times 50,000 \text{ square feet}) + (0.3 \times 2,000 \text{ square feet})] \\ &= 32.55 \times [35,000 + 600] \text{ gallons per year} \\ &= 32.55 \times 35,600 \text{ gallons per year} \end{aligned}$$

**MAWA = 1,158,780 gallons per year or 1,549 hundred-cubic-feet per year**

**Step 2. Calculate the Estimated Total Water Use (ETWU).**

The same values and formula are used as in Example 1 with adjustments based on the example hydrozone table below and inclusion of the SLA value (2,000 square feet) in this example.

$$ETWU = (ET_o)(0.62) \left( \frac{PF \times HA}{IE} + SLA \right)$$

Example Hydrozone Table with SLA

Hydrozone	Plant Water Use Types(s)	Plant Factor (PF)*	Hydrozone Area (HA) (square feet)	PF x HA (square feet)
1	High	0.8	7,000	5,600
2	High	0.7	9,000	6,300
3	Medium	0.5	15,000	7,500
4	Low	0.3	7,000	2,100
5	Low	0.2	10,000	2,000
<b>Sum</b>	<b>N/A</b>	<b>N/A</b>	<b>48,000</b>	<b>23,500</b>
6	SLA	1.0	2,000	2,000

\*Plant Factor from WUCOLS

$$ETWU = (52.5)(0.62) \left( \frac{23,500}{0.71} + 2,000 \right)$$

$$= (32.55) (33,099 + 2,000)$$

**ETWU = 1,142,472 gallons per year**

**Step 3. Compare the ETWU Calculation with the MAWA Calculation.**

In this example, the Estimated Total Water Use of 1,142,472 gallons per year is less than the Maximum Applied Water Allocation of 1,158,780 gallons per year. Therefore, the water budget complies with the MAWA.