# Chapter 6: Water Budgeting

A budget is a numerical estimate that describes a plan for the future use of resources. For the roof-reliant landscaper, a water budget is an accounting of the potential use of water during drier-than-normal years. Such a budget focuses on establishing the appropriate plant material that you expect to install according to your roof-reliant landscape plan.

An easy way to begin to understand water budgeting is to think of a typical household budget. In household financial planning, incomes are projected and expenses are estimated. Often, at the end of a given time period, any money left over goes into a savings account.

Similarly, in water budgeting for roof-reliant landscaping, the "income" is projected in terms of the number of gallons of precipitation that can be expected to be stored in a cistern. "Expenses" (or outlays) are estimated in terms of the gallons of water that landscape plants might need. Any water left over is banked in the cistern for future use.

There is one major difference between a typical household budget and a typical landscape water budget. While most household expenses tend to increase over time, a new landscape's water needs tend to decrease after the first year. That is because even appropriately chosen plants need supplemental water during their first growing year. But once established these plants need less irrigation.

## Water-Budgeting Basics: Income and Outlays

The basics are the same for every water budget. Every time period starts with a projected quantity of water in storage, and a projected quantity of income water in the form of newly harvested precipitation. These two variables will depend on the size of your catchment area, the amount of precipitation captured in a given year and the size of your storage tank. A detailed description of how to calculate the projected quantity of storage and income water is presented in Chapter 3, Sizing Your Cistern. (Also see Appendix 1 for average precipitation by month in various New Mexico cities).

## Water Outlays

Water outlays are delivered from storage to your landscape plants. There are many variables that need to be taken into account when calculating outlays, and this section is designed to estimate landscape water needs in order to determine the appropriate storage. Actual irrigation requirements will depend on several variables including age of plants, density of plantings, soil type and distribution efficiency. The irrigation requirements outlined in Appendix 4 should be used as a guideline, with appropriate adjustments for specific circumstances.

To determine how much water a given plant needs, please answer the following questions:

- Where in the state do you live?
- What is the irrigation requirement of the plant (low, medium or high)? For the purposes of this manual, low-water-use plants are called "zone 1" plants. Medium-water-use plants are "zone 2" plants and high-water-use plants are "zone 3." If you are unsure, please ask a local nursery person or county extension agent.

From a roof-reliant landscaping standpoint, the most important factor in plant irrigation is the water-use requirement of the plant. While similarly sized low-water-use (zone 1) perennials and trees do have slightly different water requirements in the landscape, these differences are not significant when compared to the differences between low-water-use plants (zone 1) and medium-water-use (zone 2) or high-water-use (zone 3) plants.

**Table 6-1: Plant Water-Use Zones**

| Water Use Requirement | Water-Use Zones |
|---|---|
| Low | Zone 1 |
| Medium | Zone 2 |
| High | Zone 3 |

NOTE: Turfgrass, as a plant category is not covered in this manual because of the high-water-use requirements of cool season grasses and the fact that too much harvested water would be wasted due to the inefficiency of sprinkler systems.

The information found in Appendix 3, Landscape Irrigation Requirements in New Mexico, shows the amount of water required by different types of plants in different parts of the state in gallons per square foot per year. Because the root area of a large "zone 2" tree covers more square footage than the root area of a flowering "zone 2" perennial, the tree requires more supplemental water to maintain than the perennial. However, the rate of water applied per square foot is the same for both plants.

To find the estimated irrigation requirements in a normal-weather year in gallons per square foot for different water-use zones, simply find the appropriate line in Appendix 3. For example:

| County | Locale | Zone 1 | Zone 2 | Zone 3 |
|---|---|---|---|---|
| Bernalillo | Albuquerque | 5.97 | 14.79 | 37.65 |

Make sure to use the irrigation requirement for your locale or the locale closest to you. For each different plant in each water-use-requirement zone, make a new entry in the worksheet in Appendix 2. The example shown below is for Albuquerque and assumes a mature landscape.

**Table 6-2: Sample Water Demand Worksheet**

| A | B | C | D | E |
|---|---|---|---|---|
| Zone | Locale | Irrigation requirement in gallons per sq. ft. per year | Square footage of irrigated area | Total gallons required (C x D) |
| 1 | Albuquerque | 5.97 | 150 sq ft | 895.5 gallons |
| 1 | Albuquerque | 5.97 | 100 sq ft | 597 gallons |
| 2 | Albuquerque | 14.79 | 50 sq ft | 739.5 gallons |
| Total | | | | 2232 gallons |

NOTE: Newly established plants need more water in order to get established in the landscape. Multiply the figures in Appendix 3 by 1.2 to determine first-year water requirements. For year two, multiply these figures by 1.1 and for year three multiply by 1.05. For all subsequent years use the figures in Appendix 3.

## Other Factors to Consider

- Factor in the seasonal demand. Throughout New Mexico, the period of heaviest supplemental irrigation is typically late June through early July. Using July as the benchmark for maximum supplemental irrigation needed (100%), all other months need less irrigation. For example, in Las Cruces during the month of April, irrigation controllers should be set to deliver only 41% of the total water that is needed for the hot month of July. See Appendix 5 for a chart of monthly water-budget settings for eight New Mexico locations.
- Most drip emitters measure water delivered in gallons per hour. To convert irrigation run times to total gallons delivered, multiply the total number of hours times the flow rate of the emitter. For example, a 4-gallon-per-hour emitter that runs for 30 minutes three times a week will deliver 6 gallons of water per week (4 gallons/hour x 0.5 hours x 3 = 6 gallons).
- Location of drip emitters is important. Watering plants too closely to the middle of their root-areas does not encourage roots to expand outward. Another common mistake is locating drip irrigation emitters too close to the trunk of a tree or the stem of a plant. Emitters should be placed at the "dripline" (the edge of the leaf canopy) of shrubs and trees. As plants grow larger, the drip emitters should be moved outward toward the dripline.
- Irrigation system efficiency. No irrigation system is 100 percent efficient. Drip irrigation systems, which are recommended for all roof-reliant landscapes, are the most efficient irrigation systems. But even drip systems lose water to leaks, improperly placed drip emitters and other factors. According to irrigation industry statistics, drip irrigation systems have an efficiency rating of 85 to 90 percent. (This means that 85-90 percent of the water entering the distribution system actually makes it to plant roots. The remaining 10-15 percent is lost to leakage or does not make it to plant roots.)
- Soil types impact run times. Sandy soils quickly direct water down and away from the root zones of plants, while soils with high clay content tend to saturate quickly, sometimes choking the roots of plants. In sandy soils,

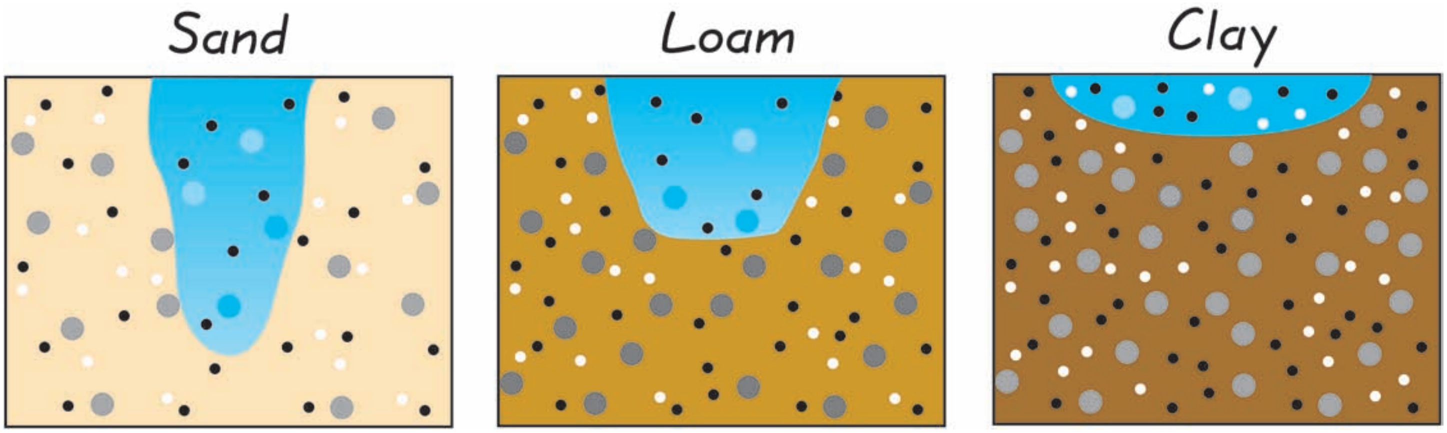


**Figure 6-1: Illustration of how soil types affect how water Is dispersed into soil**

shorter and more frequent run times can be more effective. Conversely, longer time periods between run times is a good watering strategy for clay-based soils. (See Figure 6-1 above for an illustration of how soil types affect the dispersal of water into the soil.)

- Regularly inspect plants. Plants that are receiving too much water often display symptoms similar to plants that are getting too little water, such as yellowing leaves. Therefore, determining the cause of plant stress early on can help reduce your water use.

## The Roof-Reliant Calendar

A quarterly water budget, divided into "seasons" that coincide with the climatic and precipitation patterns in the state, is recommended for roof-reliant landscapers. The water-budget fiscal year begins on September 1 and ends on August 31.

Breaking down the year in this way also relates more precisely with the extremely variable water needs that plants have during the course of the year. Specifically, most plants typically need decreasing amounts of water in fall, little to no water in winter, increasing amounts of water in spring and the most water in summer.

Dividing the year in this manner reminds us that the beginning of summer is the most important time of the year to have water stored in your cistern (because water use will be highest in this season). This seasonal calendar can also serve to remind us that fall is an excellent time to plant the less heat- and drought-adapted plants such as fruit trees and shade trees in the high-water zones (zone 3) of the landscape. Fall is also the time to begin weaning established xeric plants off of supplemental water as days become shorter and temperatures become cooler. This allows plants to start going dormant in preparation of upcoming winter weather.

For the roof-reliant landscaper, the fiscal year should start with a full cistern system. Fall comes soon after the end of a typical "monsoon" season, so the assumption that water-storage tanks will be full at the beginning of the process of water budgeting is certainly plausible—especially if your cistern installation occurred the previous winter or fall. The first season begins after the time of greatest landscape-water need and at the beginning of the time to start saving water for the next hot season.

Each season can vary considerably depending on where you live. Table 6-3 presents a guideline to the seasons for the three climatic regions of the

**Table 6-3: New Mexico's Quarterly Water-Budget Calendar by Climatic Region**

| | Southern | Central | Mountain |
|---|---|---|---|
| Season 1 (Fall) | Sept., Oct., Nov. | Sept., Oct., Nov. | Sept., Oct., Nov. |
| Season 2 (Winter) | Dec., Jan. | Dec., Jan., Feb. | Dec., Jan., Feb., Mar. |
| Season 3 (Spring) | Feb., Mar., April | Mar., April, May | April, May |
| Season 4 (Summer) | May, June, July, Aug. | June, July, Aug. | June, July, Aug. |

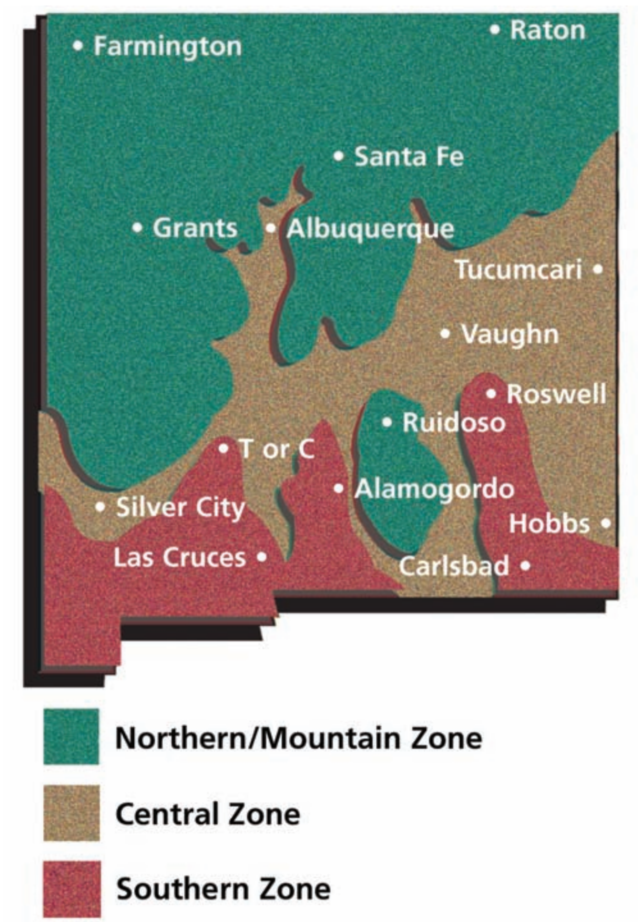


**Figure 6-2: New Mexico has three major climatic regions, as depicted on this map.**

state. Please contact your county extension agent for localized information.

Below is a quick summary of the watering goals and strategies for each quarter of the water-budget calendar year. Remember that precipitation not only fills up your cistern but also waters your plants, so adapt your watering schedule accordingly.

- Season 1/Fall. Water sparingly, especially as the season progresses. The exception is for new plantings, which will need extra supplemental water to get established. (Your cistern should be relatively full after the summer monsoon season.)
- Season 2/Winter. Most plants are dormant, so refrain from watering. Trees, especially evergreens, may need monthly watering during dry months with little or no precipitation.
- Season 3/Spring. A time for frugal watering that keeps plants alive but reserves as much water as possible. Watering should increase as temperatures rise with the approach of summer.
- Season 4/Summer. Plants need the most water during the hottest months of the year. Being prepared for the beginning of the hot weather with water stored in the cistern is critical. The monsoons should begin to refill your cistern and start the cycle again.

Due to its higher temperatures, Season 4 of the water budget fiscal year is often the most challenging. But given a "normal" monsoon season in New Mexico, a realistic planting plan and conscientious water saving during the three previous seasons, your landscape should have no difficulty surviving the heat of summer. In fact, the summer months are when cisterns can fill up rapidly, sometimes to capacity.

Before detailing a water budget, it is important to address weather variations. New Mexico weather varies not only by location and elevation but also from year to year. Floods, drought, late and early freezes, high temperatures and wide temperature variations are all part of our weather cycle. Prepare your landscape to survive these extreme conditions by planting appropriate drought-tolerant species, encouraging deep roots and storing water for the days without rain.

## Water Income

It is also extremely helpful to know when in the year it is most likely to rain. On average, the "typical" year's rainfall in New Mexico will be delivered as follows:

- One-eighth will be harvested in Season 1 (September, October and November).
- One-quarter will fall in Season 2 (typically December, January and February).
- One-eighth will be harvested in Season 3 (March, April and May).
- One-half of the year's precipitation will come in Season 4 (June, July and August, in most parts of the state)[7].

[7] Based upon recent data, precipitation patterns may be changing and New Mexico's summer "monsoon" season may not be as predictable or consistent as in the past. Nevertheless, New Mexico continues to receive a large percentage of its annual precipitation during the warmer months.

If 12,000 gallons of water income is anticipated to be harvested per year, the first season (fall), of the water budget year will typically produce 1,500 gallons of new water. During the second season (winter), 3,000 gallons will be collected and the third season (spring) will provide 1,500 gallons. The total new-water income expected during these three seasons is 6,000 gallons.

Let's assume that your cistern holds 6,000 gallons, and that you start the water budget year (September 1) with a full cistern. In this example, the total anticipated water budget for the first three seasons of the year is 6,000 gallons of new income plus 6,000 gallons of previously stored water, or 12,000 gallons of total water income from September through May. However, since the goal is to start the fourth season of the year with a full cistern (because it is the hottest part of the year), of the 12,000 gallons only 6,000 gallons of it is useable income.

In the example above, the estimated fourth-quarter water budget would be 12,000 gallons (6,000 gallons in storage plus the anticipated 6,000 gallons in new water to be harvested during the fourth quarter). Because some years are drier than "normal," it is wise to estimate usable fourth-quarter income at approximately 80% of maximum. Consequently, you should install plant material that can survive on approximately 9,600 gallons of water during June, July and August.

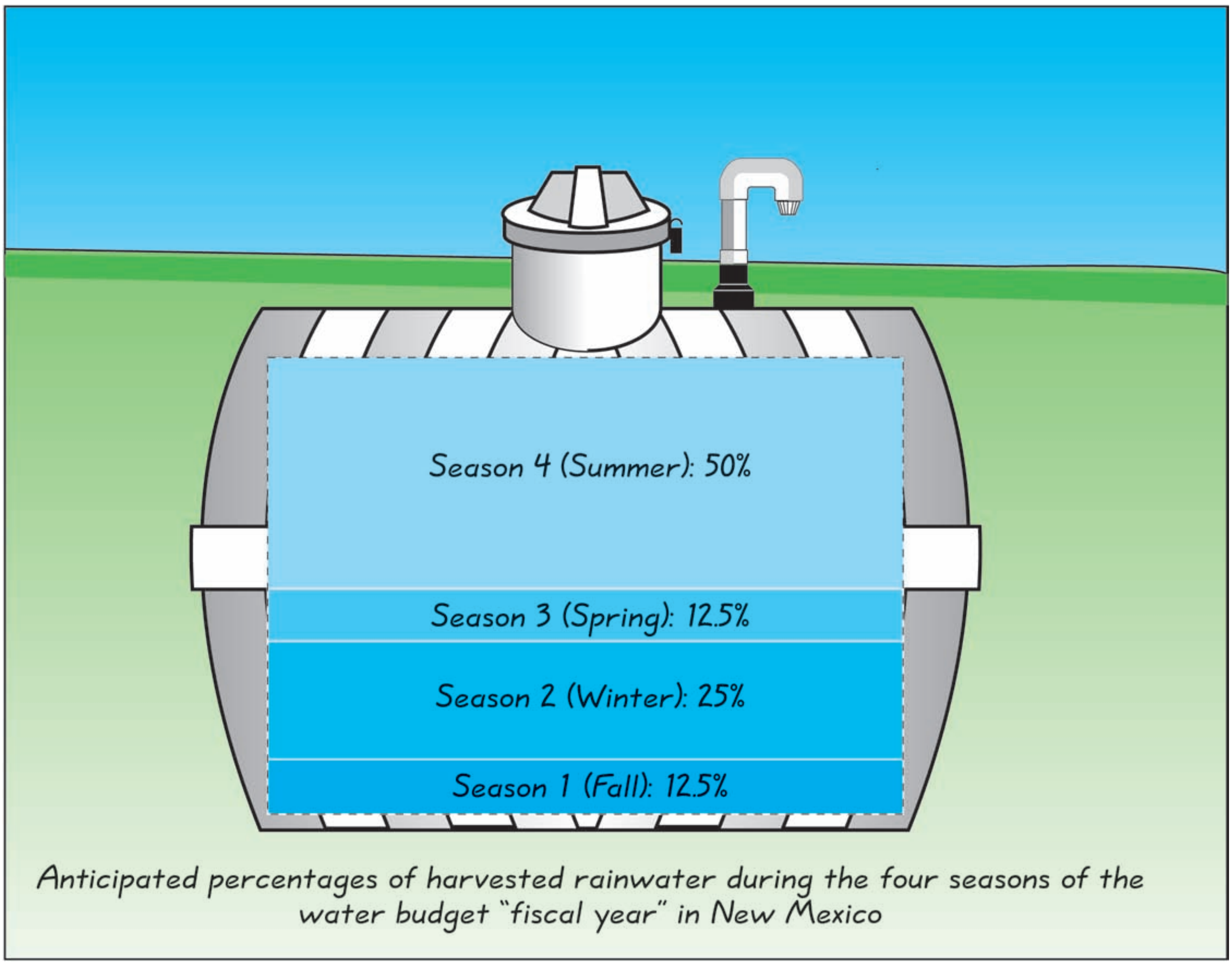


**Figure 6-3: Anticipated percentages of harvested rainwater during the four seasons of the water budget year in New Mexico. One-half of the expected rainfall occurs during Season 4—New Mexico's summer "monsoon" season.**