Roof-Reliant Landscaping™

Rainwater Harvesting with Cistern Systems in New Mexico

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Preface

The term "rainwater harvesting" is used primarily to describe a landscaping strategy designed to capture rooftop precipitation for irrigation of the landscape, reducing the need for supplemental potable water. As the agency charged with administering the state's water supply, the New Mexico Office of the State Engineer (NMOSE) promotes a variety of water conservation strategies[1]. One strategy with excellent potential for significant water conservation is the Roof-Reliant Landscaping™ method presented in this manual[2].

Because New Mexico is an arid state with significant water challenges, there is a renewed interest statewide in the concept of rainwater harvesting and cisterns. During the hottest summer months in New Mexico, more than half of the total metropolitan water use in residential neighborhoods in Albuquerque goes toward landscape irrigation. Rooftop rainwater harvesting, along with other outdoor water reuse practices, can reduce the demands on municipal water systems and our aquifers.

As increased cycles of drought coupled with population growth strain our limited water resources, not only does it make sense to explore ways to get the most use of rainwater, it is also wise to design and create landscapes that need little or no supplemental water to thrive. The Roof-Reliant Landscaping™ method detailed in this manual begins by emphasizing the need to adhere to xeriscape principles (waterwise landscaping techniques).

New Mexico receives 12 inches of precipitation per year on average. The Office of the State Engineer continues to respond to the public's need for new and progressive ways to conserve New Mexico's limited water supply. In the near future, look for a recommended list of "Waterwise Plants of New Mexico" with a column dedicated to "precipitation only plants." NMOSE will also be developing an Irrigation Calculator, which will help users to determine the appropriate amount of water to use for their landscapes.

Water is a precious resource in New Mexico, and it is in our best interest to be good stewards of this life-giving resource. Committed water conservation efforts will result not only in significant water savings, but also in appropriate public spaces and beautiful and responsible landscapes.

We ask the readers of this manual to visit the Water Use and Conservation section of our website www.ose.state.nm.us.

NEW MEXICO OFFICE OF THE STATE ENGINEER
Rainwater/Snowmelt Harvesting Policy

The New Mexico Office of the State Engineer supports the wise and efficient use of the state's water resources and, therefore, encourages the harvesting, collection and use of rainwater from residential and commercial roof surfaces for on-site landscape irrigation and other on-site domestic uses.

The collection of water harvested in this manner should not reduce the amount of runoff that would have occurred from the site in its natural, pre-development state. Harvested rainwater may not be appropriated for any other uses.

For additional information visit http://www.ose.state.nm.us and click on Water Use and Conservation.

[1] For more information, please contact the OSE's Water Use and Conservation Bureau's toll free phone number 1-800-WATER-NM or visit www.ose.state.nm.us

[2] This manual applies to landscape uses of harvested rooftop water only. The use of rainwater for drinking purposes is beyond the scope of this publication.

Introduction

Make you every man a cistern in his house. **–King Mesha of Moab, 850 B.C.**

Cistern systems date back several thousand years. In its simplest form, a cistern system collects rainwater that falls on a roof so that the collected water can be used at a later time. Unfortunately, when the industrial age brought the ability to pump water from distant places at a relatively low cost, modern society forgot that roofs could be efficient and convenient water collection surfaces.

In a dry state such as New Mexico, it makes sense to explore ways to get the maximum use of natural precipitation. It is also wise to design and create landscapes that need little or no supplemental water to thrive. Roof-reliant landscaping™ combines these two ideas in a waterwise landscaping strategy.

A roof-reliant landscape is designed to survive on the natural precipitation that falls on the plant material—plus the water that can be harvested from the roofs of onsite buildings and stored in a cistern for later distribution. "Totally" roof-reliant landscapes need no supplemental water (such as surface water or groundwater) to maintain the health of the plants. Plants that require no supplemental water are often called "precipitation-only" plants. Landscapes are defined as "primarily" roof-reliant when the associated plants get over 75% of their water from natural precipitation off a nearby roof during the first five years after the plants have been installed.

Establishing a roof-reliant landscape—or any landscape that is designed to thrive in a local climate with low water-use requirements and low maintenance—takes careful planning. In addition, site design, plant knowledge, an ability to work within a budget and patience are all important characteristics of a roof-reliant landscaper.

Because the goal of a roof-reliant landscaper is to reduce or eliminate the dependency on supplemental sources of water, knowledge of appropriate native and adapted plant material and water-conserving landscaping techniques is crucial. Although each landscape is different and presents specific onsite conditions and challenges, understanding the relationship between the variables of your landscaped area, the plants you select and your cistern's storage capacity is vital to the successful implementation of a roof-reliant landscape.

A Long-Term View

A roof-reliant landscape is not a short-term project that can be quickly accomplished in a weekend. Rather, it takes careful planning and patience to establish such a landscape. By definition, roof-reliant landscaping uses plants that (1) can establish themselves within three to five years and (2) can, once established, bounce back quickly after a period of drought.

In an ideal roof-reliant landscape, plant material is phased in over the course of several years so that the landscape can fit within a strict water budget[3]. One example of such a schedule might be:

- **Year 1:** Develop the landscape plan and design the cistern system in the winter. Install the cistern system in the spring. Harvest water during the summer monsoon season. Plant trees in the fall. (Xeric trees generally need 6-8 weeks for root growth before the first hard freeze.)

- **Year 2:** Install hardscape areas (including shade structures) and any important landscape features that do not require water throughout the year. If enough water is stored in the cistern and enough money exists in the budget, plant xeric shrubs in late summer or early fall.

- **Year 3:** Harvest precipitation throughout the winter, spring and summer. If enough water is stored in the cistern and enough money exists in the budget, plant heat-loving xeric perennials and shrubs during warm weather and cold-adapted plants in the early fall.

- **Year 4:** Harvest precipitation throughout the year and continue to establish plants.

- **Year 5:** Given normal years of precipitation, much of the landscape could be established at this time. Attempt to keep at least 67% of the cistern filled in order to be prepared for drought.

[3] See Chapter 6 for more information on water budgets

Figure A-1: A healthy waterwise landscape can take several years to establish. This landscape in northern New Mexico is irrigated with rooftop harvested water using a drip system.

This schedule is not *required* for a landscape to become totally roof reliant, but it is *highly recommended* that plants be gradually established over a period of years so that more plant material can be planted over a longer time frame. An alternative schedule might divide a landscape into distinct areas for development beginning with those areas that are the most visible. For example, you might choose to install your front-yard plants in the first year, the backyard plants in the second year and the side-yard plants in the third year.

Please note that although this manual is focused on the roof-reliant landscaper who is installing a new landscape, much of the information contained here is also helpful for those who would like to incorporate a cistern into an existing landscape. This manual would be helpful as well for anyone who would like to gradually make the shift from using potable water for landscape irrigation to using rooftop harvested rainwater. In fact, those who already have an established landscape may be able to make the switch from potable water to harvested rainwater fairly quickly. Even if you're not ready to make the commitment to total roof-reliant landscaping, rainbarrels and cisterns can reduce the amount of supplemental (potable) water needed by your landscape. It makes sense for property owners in New Mexico to understand and install rainwater harvesting systems whenever possible.

A Brief Overview of This Manual

This manual is designed to introduce the concept of roof-reliant landscaping in a logical manner that begins with a basic introduction to xeriscaping (waterwise landscaping techniques) and continues through a detailed "how-to" discussion of cistern system design, construction and maintenance. Here's a quick summary of each chapter:

Chapter 1: The Fundamentals of Waterwise Landscaping

Understanding the basics of waterwise landscaping is crucial to the success of any roof-reliant landscape. Although this might be a "refresher course" for many who read this manual, applying the principles of xeriscaping and selecting appropriate plants must be considered baseline knowledge before any waterwise landscape can be designed and any cistern system planned.

Chapter 2: The Basics of Cistern Systems

Water collection can be as simple as catching rainwater from a downspout and storing it in a rainbarrel. More elaborate systems are described and depicted to introduce the terminology that will be used throughout this manual.

Chapter 3: Sizing Your Cistern

An equation for predicting potential rainwater harvests uses simple arithmetic to approximate how much water can be collected from your roof in a normal year. With this figure, you can determine an appropriate size for your property's cistern.

Chapter 4: Landscape Planning and Design

Thorough landscape planning can save money, time and water, so it is an essential element of every roof-reliant landscape. A landscape plan determines the size and location of your cistern system, a significant step undertaken before designing any cistern system.

Chapter 5: Cost Estimating

Cistern systems, particularly underground cistern systems, can be expensive to install. The materials are often heavy, delivery can be expensive, a surprisingly large number of subcontractors can sometimes be involved and the sheer size of the excavation for an

underground tank is substantial. This means that a thorough cost estimating process is essential.

Chapter 6: Water Budgeting
This manual takes a seasonal approach to water budgeting, by creating a working water budget that accurately predicts harvested inflows to the cistern and potential outflows to landscape plants. With this budget approach, water can be more efficiently allocated to the appropriate plants as needed.

Chapter 7: Water Collection
The fundamentals of how to collect rooftop rainwater are covered in this chapter. The impact of flat roofs versus pitched roofs on water collection is discussed, as is the effect of roofing materials on water collection.

Chapter 8: Water Conveyance
Once the water has been collected off the roof, it has to be conveyed to a storage tank. How the water is conveyed and how it is filtered has to be carefully planned for a water system to be successful.

Chapter 9: Water Storage
Cisterns (or water storage tanks) are the heart of roof-reliant landscaping. Cistern components and materials are discussed in detail. The advantages and disadvantages of aboveground and underground cisterns are presented along with information about cistern placement.

Figure A-2: A water storage tank is the heart of a roof-reliant landscaping system. Shown here is a 10,000 gallon aboveground corrugated metal tank.

Chapter 10: Water Distribution
The distribution of cistern water to the root zones of plants is the final step in the rainwater harvesting cycle. There are many techniques that can be employed to distribute harvested rainwater—ranging from a simple garden hose to an elaborate drip irrigation system. The greatest potential for water waste occurs during the distribution process, so careful planning and regular monitoring of the manner of distribution is vital.

Chapter 11: Maintenance
After the design, installation and successful use of a rainwater harvesting system, the roof-reliant landscaper's work isn't over. In order to keep the system functioning efficiently, routine inspections and maintenance are required on a regular basis.

To make this manual as user-friendly as possible, following the body of the text are various appendices, a bibliography, a list of helpful websites and resources and a glossary of terms. In addition, worksheets are provided to assist in the development of a roof-reliant landscape. Additional copies of these worksheets are available at http://www.ose.state.nm.us (click on Water Use and Conservation).

Call Before You Dig
Call 1-800-321-2537 before beginning any excavation.

Please note that nothing in this manual should be construed as an endorsement of any product, person, or corporation. Any and all references to products, persons, and corporations herein are intended merely to provide a brief and general sketch of the ever-expanding field of cistern technology. Since new advances in cistern technology are being made constantly, the Office of the State Engineer strongly encourages you to complete your own due diligence when it comes to choosing the cistern system's material that is best suited for your particular situation.