Chapter 7: Water Collection

When it comes to rainwater harvesting in New Mexico, the major question concerning your roof is whether it is pitched or flat.[8] Pitched roofs are slightly more efficient than flat roofs for water harvesting, but flat roofs are quite suitable surfaces for rainwater collection as well.

The "Pitch" for Pitched Roofs

When it comes to harvesting precipitation, pitched roofs provide a cleaner resource than flat roofs because less debris accumulates on them. Flat roofs have parapets that prevent debris from being blown or sliding off the roof. When significant storm events occur, anything on a pitched roof will quickly wash away, while at least some portion of the debris on a flat roof is left behind to slowly decompose on the water-collection surface.

Many materials used in flat roofs leach low levels of toxic chemicals, but as long as your cistern is locked and marked "nonpotable," this should not be a problem.[9] Plants should thrive as a result of being watered by your harvested precipitation.

Pitched roofs collect a greater amount of precipitation than flat roofs for the following reasons:

1. Less precipitation evaporates off of pitched roofs than off of flat roofs because the angle of a pitched roof directs precipitation more immediately to the conveyance system. Since the precipitation landing on a flat roof moves much more slowly than that landing on a pitched roof, the sun, wind and ambient air have an increased amount of time to cause evaporation.
2. The gravel that is typically part of a flat-roof system prevents rain and snow delivered from light-precipitation events from making it to the system's conveyance piping. Water is inhibited from flowing toward the initial conveyance points, and the gravel, with its multiple surfaces, causes significant evaporation, especially when conditions just prior to precipitation were hot and dry.
3. Given an identical building footprint, the square footage of a pitched roof is typically larger than that of a flat roof. This is due to the overhangs associated with pitched roofs, which add catchment area.
4. The conveyance system for a pitched roof is usually slightly less expensive to install and slightly more efficient at transporting water than that of a typical flat roof. (This will be made more apparent in Chapter 8, Water Conveyance.)

Runoff Coefficients

When calculating the amount of runoff that can be harvested from a roof, it is common to include a runoff coefficient. This coefficient accounts for the fact that some roof surfaces are more efficient than others at collecting rainwater. For example, a pitched metal roof is typically the most efficient type of roof for collecting water, delivering 95% of the water that falls on it (except for some heavy snowfalls). Conversely, a flat tar-and-gravel roof is typically the least efficient roof type, delivering 80-85% of the water that falls on it. Table 7-1 lists the runoff coefficients for common roof materials.

Table 7-1

Runoff Coefficients for Common Roof Materials	
Metal	0.95
Asphalt	0.90
Concrete	0.90
Tar and gravel	0.80-0.85

Please note that the figures in Table 7-1 are estimates. In a very light rain event, the runoff coefficient can equal 0.00, since no rainwater will flow through your catchment system into your cistern.

[8] Throughout the text, the common term "flat" is used to describe both flat and seemingly flat, low-sloped roofs.

[9] For water quality issues, contact the New Mexico Environment Department Water Quality Bureau.

In Chapter 3, Sizing Your Cistern, the runoff coefficient was not included in the calculations you made when estimating anticipated rainwater harvests. Instead, you were encouraged to use a generally cautious approach to predicting rooftop rainwater harvests. The decrease in harvested rainwater due to loss from the runoff coefficient was one of the reasons for this. If you would now like to include the runoff coefficient in your rainwater harvesting calculations, you can more accurately predict the net runoff.

Roof Materials (Pitched Roofs)

Pitched roofs are constructed using a wide variety of materials, including metal, tile, shingle, slate and treated wood. From a water harvesting perspective, metal is the preferred pitched roof material because of its high runoff coefficient and because other more-porous roof materials can leach toxins into your cistern and, ultimately, to the root zones of your plants.[10]

Metal. A pitched, sheet metal roof is the cleanest and most efficient collection surface available. It provides a smooth surface that conveys water efficiently. Sheet metal is competitively priced throughout much of New Mexico and lasts a long time under normal conditions. Metal tile is also available, but it is more expensive and less efficient at collecting water. Metal is a relatively durable and long-lasting roof material, and it is priced in the mid-range for roof materials. (See Figure 7-1.)

Asphalt. Asphalt roofs are popular because they are made from some of the least expensive roofing materials available. Asphalt shingles are typically made of either a paper-based or a fiberglass-based mesh soaked in asphalt. Due to the leaching that can occur from asphalt shingles, this is a poor roof choice from a water quality perspective.

[10] More info concerning environmental issues of roof materials may be found at: http://www.austinenergy.com/energy%20efficiency/programs/green%20building/Sourcebook/roofing.htm

Figure 7-1: A pitched metal roof is the most efficient catchment surface for rainwater harvesting.

Clay. In some parts of the world, clay tile roofs are the dominant roofing material. Although clay makes a great material for water harvesting due to its smoothness, clay tile is not especially popular in New Mexico because it is usually more expensive than metal roofing and the tiles need to be replaced more often because they crack easily in our freeze-thaw climate.

Slate. Slate is a very smooth and exceptionally durable surface, which makes it excellent for water harvesting. However, slate roofs are not common in New Mexico because slate is expensive to import from the few eastern states that quarry it. Slate typically comes in small rectangular tiles (also called shingles), but it is a relatively heavy material, which further increases the high cost of shipping.

Concrete. Concrete tile can be a good roof choice in New Mexico due to its ability to insulate the building it covers. A small portion of each storm's water will be absorbed due to the natural porosity of concrete; however, this water, which ultimately evaporates, is usually not a significant quantity. Concrete roofing is noncombustible and can be a good alternative to other materials in fire-prone areas.

Fiberglass. Laminated fiberglass shingles contain the same materials as some asphalt shingles, but they last up to twice as long as regular asphalt shingles. The potential leaching of asphalt and fiberglass make this a poor choice from a water harvesting perspective. In addition, fiberglass roofing is fairly costly.

Glass and polycarbonate sheets. Sunrooms, greenhouses and solariums are some of the typical places where you will find both glass and polycarbonate roofing. Due to their extremely smooth quality, glass, polycarbonate sheets and other types of glazing are often among the most efficient surfaces available for harvesting precipitation.

Wood. Wood roofs are usually built using shingles made either of a hard wood that contains a natural resistance to rot or of wood that has been treated with a rot-resistant chemical. They are often very attractive, usually relatively expensive and typically the most flammable of standard roofing materials found in New Mexico. Wood roofs are neither the most efficient nor the most inefficient of water collection surfaces.

Asbestos. Due to its toxicity, it is wise to avoid materials that contain asbestos when designing your cistern system. Fortunately, asbestos use in building materials has declined significantly since 1980, but trace amounts can still be found in some asphalt shingles, asphalt roofing felt, cement roofing shingles and wood shingle vapor retardants. Keep in mind that serious health-related problems often occur during the removal of asbestos, so licensed professionals need to be hired when removing a roof containing asbestos.

Roof Materials (Flat Roofs)

As discussed above, while so-called flat roofs are not the preferred type of roof from a water harvesting perspective, they are quite effective at harvesting water nonetheless. When the collected water is designated for nonpotable uses such as watering plant material, the drawbacks, in terms of both water quality and quantity, are relatively minor. If your roof happens to be flat, be assured that you can create a totally roof-reliant landscape with any of the flat roof materials commonly used in New Mexico. (See Figure 7-2.)

Asphalt. A wide variety of asphalt-based roofing materials is available for flat roofs, including tar and gravel, built-up roofs, cap sheet, torch down and roll roofing. The advantage of asphalt products is their relatively low cost. The downside of these materials is that the asphalt will slowly leach toxins into your cistern system. However, your plants will be able to tolerate these low levels of toxins without difficulty. (See Figure 7-3.)

Rubber. An increasingly popular kind of roof is made primarily out of a rubber product known

Figure 7-2: Although not the most efficient surfaces for harvesting rainwater, flat roofs can serve well as catchment areas for roof-reliant landscaping systems.

Figure 7-3: Asphalt shingle roofs, which are popular because they are relatively inexpensive, can be efficient for water harvesting.

as ethylene propylene diene monomer (EPDM). Seamless, long lasting, durable and less toxic than asphalt, EPDM is becoming more price-competitive. It has none of the strong odors associated with asphalt and is sometimes touted as a "green" roof since the rubber content can be made out of recycled materials.

Modified bitumen. This material is an asphalt-based product that contains a unifying agent, or modifier, that enhances the waterproofing characteristics of the asphalt. These modifiers include rubber, polyester, fiberglass and atactic polypropylene. If properly installed, such roofs should last longer than typical tar-and-gravel roofs, but they also require more skill to install than most flat asphalt surfaces.

Polyurethane. Another alternative is polyurethane foam, which leaches fewer toxins than many of its flat-roof counterparts, making it a good choice for water harvesting projects. Although it is more expensive than some of the other roof materials, polyurethane foam is an excellent insulator. Polyurethane must be covered with either a UV-resistant coating or, like many asphalt roofs, with gravel.

NOTE: The information presented in this chapter is intended to be an overview of some of the most common roofing types and materials. Other roof materials may also provide suitable surfaces for catchment areas, and further advances in technology will no doubt result in additional choices. Some of the newest options—including PVC single sheet membrane and thermoplastic polyolefin (TPO) membrane—offer efficient catchment surfaces and low toxicity. When choosing a surface for a new roof, it is important to select a nontoxic or low-toxic material that provides a high runoff coefficient.