

# Semi-Arid Green Infrastructure Toolbox

## Rainwater Harvesting Practices



### What is a rainwater harvesting?

Rainwater harvesting is the collection, storage, and use of rainwater for landscape irrigation or other uses. Rainwater harvest systems consist of three primary components: a rainfall capture system, a vessel for water storage, and a dedicated end use for the water. These components exhibit wide variation in sizes and materials. The practice can be implemented at a diverse range of scales from the single family home to a large industrial, commercial, or institutional facility. Harvested rainwater is often used for non-potable uses such as landscape irrigation or exterior washing but can be used for interior uses such as toilet flushing or even potable supply if appropriate water treatment systems are designed and implemented.

#### Rainbarrels

Rainwater harvesting systems which capture runoff from roof leaders on small buildings and use a barrel or similar sized device as a storage vessel are commonly called "rainbarrels" referring to the common appearance of the storage vessel. Rainbarrels are the most common style of rainwater harvest systems to be implemented given their low cost (as low as \$50) and simple design and construction. They can usually be retrofitted on existing homes by those with limited skills and equipment. Rain barrels are typically 50-60 gallons in size and constructed of plastic due to its low cost and resilience however some rainbarrels are manufactured of wood, fiberglass, or concrete. Most rainbarrels utilize a gravity flow distribution

system in which the user opens a valve to drain collected water through a small hose.

#### Cisterns

Rainwater harvest systems which employ larger storage vessels and capture runoff from more than one or two roof leaders are typically called cisterns. Cisterns may range in size from a few hundred gallons up to hundreds of thousands of gallons for the largest systems. The cistern vessel can be constructed above or below ground and often include a pump to provide pressurized water flow for running an irrigation system or other end use. Given their larger size, complexity, and cost more detailed analysis is generally conducted during the design of a cistern as compared to rainbarrels. Costs for cistern systems is usually several thousand dollars and varies widely based on size and materials. However it is possible to realize significant cost savings by repurposing existing materials.

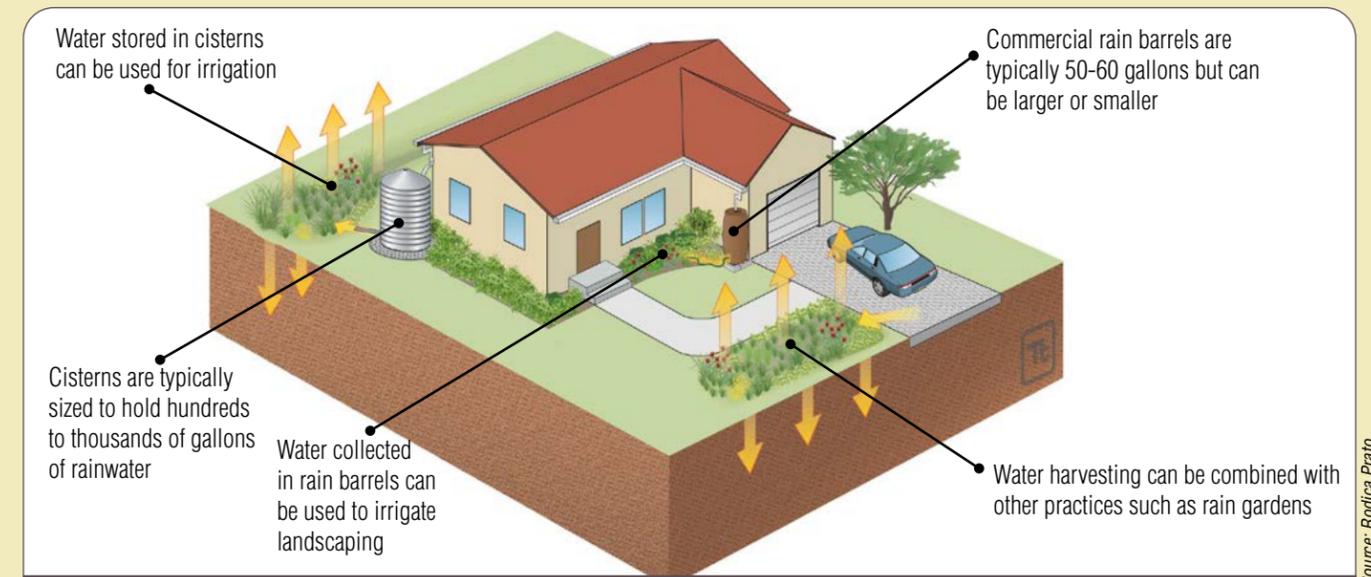
#### Benefits

Rainwater harvesting provides a number of benefits:

- Reduces demand on potable water supplies
- Reinforces the value of water resources to the end user
- Saves water costs to homeowner
- Supports healthy landscapes

#### Siting and design considerations

Rainwater harvesting systems are notable in their variety of implementation. Storage vessels range from used wooden whiskey casks to corrugated galvanized steel tanks to subsurface concrete vaults. All of these systems however must include a system to capture runoff from a rooftop or paved surfaces. The majority of cisterns rely on rooftop runoff to supply water as it is generally free of sediments and contains much less contaminants than runoff from paved surfaces. A key feature of rainwater systems is a screen or filter system which prevents leaves and other debris from entering the storage vessel. Some systems also are configured to prevent mosquitoes or other insects from accessing the cistern preventing them from becoming mosquito breeding grounds.



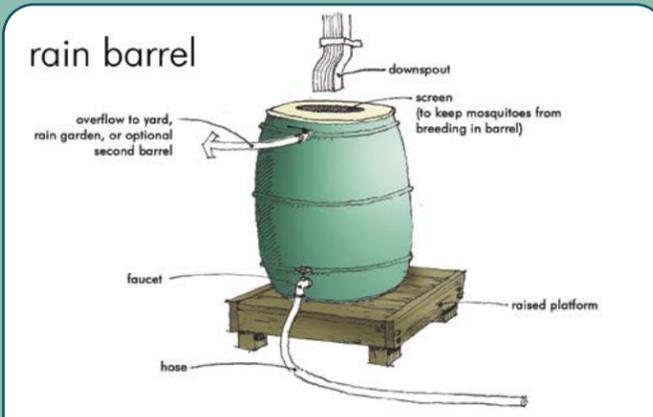
Source: Rodica Prato

Planter Box configuration of a bioretention system exhibiting 6 in. vertical curb with openings and adjacent sidewalk. Note that an underdrain system is required if existing soil is low permeability.



Source: Neponset Stormwater Partnership

This residential rainbarrel incorporates a screen at the intake to keep out debris, mosquitoes and other creatures.



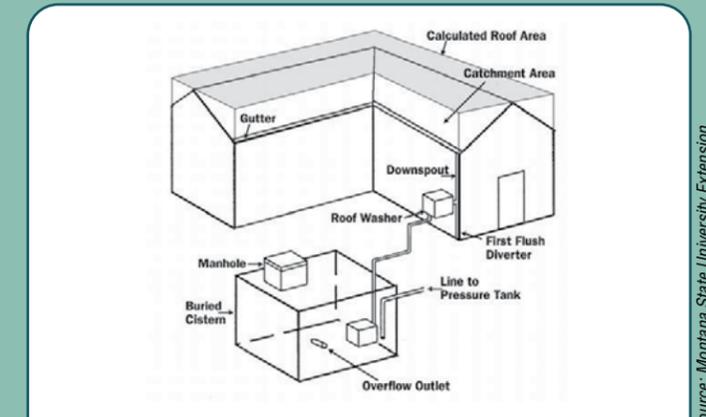
Source: Eagle Creek Watershed Alliance

This simple rainbarrel schematic shows a gravity garden hose drain line.



Source: Technicians for Sustainability (tfsolar.com)

A residential cistern in Tucson, Arizona.



Source: Montana State University Extension

This variation of a cistern system uses an underground tank and pumped supply line.

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### How to plan, implement, and maintain rainwater harvesting practices



**Planning and Design:** Rainwater harvesting practices are notable in their variety of implementation. Storage vessels range from used wooden whiskey casks to corrugated galvanized steel tanks to subsurface concrete vaults. All of these systems however must include a system to capture runoff from a rooftop or paved surfaces. The majority of cisterns rely on rooftop runoff to supply water as it is generally free of sediments and contains much less contaminants than runoff from paved surfaces. A key feature of rainwater systems is a screen or filter system which prevents leaves and other debris from entering the storage vessel. Some systems also are configured to prevent mosquitoes or other insects from accessing the cistern preventing them from becoming mosquito breeding grounds. There are a variety of online tools available which the user can use to determine appropriate size of the catchment area diverted to the system and the size of the storage vessel. Some tools allow the user to estimate potential water demand and consider potable water costs to compute a payback period based on water savings. The American Rainwater Catchment Systems Association maintains a list of many of these tools and online calculators. A common cause of failure for rainwater harvest practices is the abandonment of the practice so that captured water is not used and the vessel stays full of water for a long period of time. This issue is particularly troublesome with rainbarrel systems which require active use by the homeowner. Some rainbarrels incorporate a secondary drawdown hose to ensure that some volume of the barrel is available for successive precipitation events.

**Maintenance:** Maintenance of rainwater harvesting practices focuses on preventing anything other than water from entering the storage vessel and ensuring that captured water used prior to the next rainfall event. Many systems incorporate a first flush diverter or rain screen at the inlet to keep out debris and small animals which can lead to foul smelling water and a negative association with the practice. In colder climates the system may need to be taken offline in the fall of the year as colder temperatures could freeze stored water and cause damage to components. Its important to remember to reconnect the system in the spring.

### Recommended Rainwater Harvesting Practice Maintenance Activities

#### As Needed:

- Check the entire system to ensure the barrel is functioning properly.
- Regularly use water collected in your rain barrel between rain events to make sure there is room to collect stormwater during the next storm.
- Place gutter guards and/or screens on top of the roof downspouts and on top of the barrel to keep leaves and debris from entering the rain barrel.
- Remove leaves and other debris from the screen at the top of the barrel, the overflow pipe, and the roof gutter.

#### Seasonally:

- Disconnect the rain barrel during the winter to avoid damage. Disconnect it from the downspouts, empty the barrel, wash it out, and store it upside down in a protected location.
- Open the rain barrel spigot if you expect to be away for an extended period of time; make sure it will drain away from your foundation.
- Clean the barrel using a non-toxic substance to remove residue or algae.
- Clean out downspouts and roof gutters for the most effective mosquito control. However, if you find mosquitoes in your rain barrel, you may use a mosquito-control product such as Mosquito Dunk (follow manufacturers' instructions).

#### Avoid:

- ✗ Don't leave water in your rain barrel for long periods of time
- ✗ Don't drink the water in your rain barrel or use the water inside your home or for your pets.
- ✗ Don't let children play in or around a rain barrel.
- ✗ Don't spray the water directly on vegetables or leaves, as the stormwater may contain bacteria.
- ✗ Don't let the barrel foundation become unlevel or unstable. A full 55-gallon barrel weighs 450 pounds and can tip over on an unstable surface.
- ✗ Don't forget to reconnect your rain barrel every year after the threat of frost has passed.

More rainwater harvesting:



Steel cistern



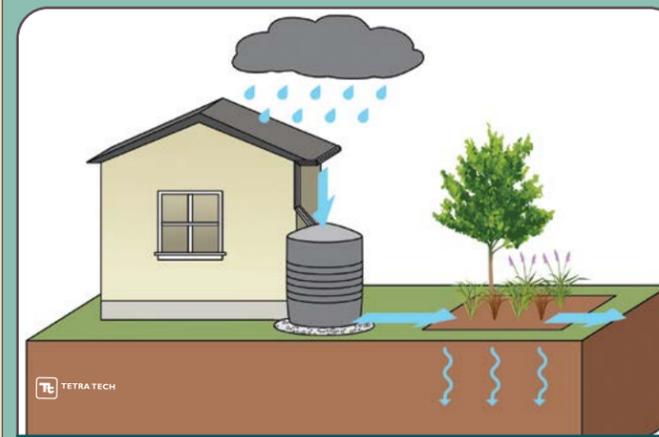
Trickle drain to ensure passive function



Painted rain barrel



Plastic cistern at a residence



Schematic of cistern at a residence draining to a rain garden

Source: Chesapeake Bay Foundation

Source: NC Division of Environment and Natural Resources

Source L-R, Top to Bottom: Texas A&M, Neponset Stormwater Partnership, Colorado Public Radio, Portland Purple Water (Flickr), T