

Rainwater Harvesting with Cisterns and Rain Barrels



Photos courtesy of CatchingH2O

Why harvest rainwater?

When it rains, stormwater flows from roofs, sidewalks, streets and other urban surfaces into city storm drains, picking up pollution and trash along the way. Water that enters the stormwater system flows untreated directly into our creeks, rivers, bays, beaches and, ultimately, the ocean. Instead of letting this rainwater flow off your property, you can collect some of it in rain barrels and cisterns (also referred to as rain tanks). Collecting rainwater before it washes across the landscape can provide the following benefits:

- ✓ **Water Conservation** - Rainwater that you collect during the rainy season can be used to water your plants, reducing the need to use potable municipal water (also known as “tap water”) for irrigation and contributing to water conservation efforts.
- ✓ **Pollution Prevention** - Keeping rainwater on your property helps protect water quality by reducing the volume of stormwater and pollutant flows to our storm drains, creeks, bays and beaches.
- ✓ **Flood Reduction** - Collecting rainwater in a rain tank can help reduce flooding around your property and neighborhood.

The information below is intended to provide an overview of example approaches for design and installation of a cistern and rain barrel system for informational purposes only and is not intended to provide complete instruction. Always follow manufacturer instructions for installation and if you aren't sure, hire or consult with a qualified contractor.

How to get started

Estimate how much rainwater you can collect from your roof

Did you know that one inch of rainwater falling on a 1,000 square foot roof will produce about 600 gallons of rain runoff? You can use the formula below to estimate how much rainwater will run off your roof during a single rain event or across an entire rainy season. This will give you an idea of how much rainwater you can collect on your property:



*Note: 0.62 is a constant that converts square foot inches to gallons. 0.9 is a coefficient that accounts for rainfall lost to evaporation, wind and minor infiltration into the roof surface.

Types of rain tanks

Rain tanks are available in sizes from 45 gallons to 5,000 gallons or more. In general, tanks with a capacity less than 200 gallons are referred to as rain barrels, while tanks with a capacity greater than 200 gallons are referred to as cisterns.



Cisterns (200 gallons capacity and up)

Water Storage - Cisterns are designed to store water for up to a year or more (when maintained properly).

Conveyance Capacity - Cisterns have large openings that can accommodate large conveyance pipes, allowing higher volume flows to be collected safely.

Lifespan - 25 years or more if properly maintained.

Space Efficiency - Larger than rain barrels, but more space efficient in terms of storage capacity- a single cistern will have a smaller footprint than many rain barrels with equivalent combined capacity.

Cost - Cisterns are more expensive than rain barrels but are usually less expensive on a cost per gallon basis compared to rain barrels.



Rain Barrels (45-199 gallons capacity)

Water storage - Rain barrels need to be emptied every two weeks to prevent water quality issues in the tank.

Conveyance Capacity - Rain barrels have smaller openings and fittings and thus are limited in how much flow they can manage; must be actively managed during high heavy rainfall to avoid flooding.

Lifespan - About 10 years if properly maintained.

Space Efficiency - Can be a good option for collecting 50 to 100 gallons of rainwater in a small or temporary space.

Cost - Individual rain barrels are often less expensive than cisterns, but usually more expensive on a cost per gallon basis compared to cisterns.

Deciding on the size of a tank to fit your goals

When planning for your rainwater harvesting system it's important to consider your goals – why would you like to harvest rainwater? This will help inform sizing and design of your system.

Examples of common goals include:

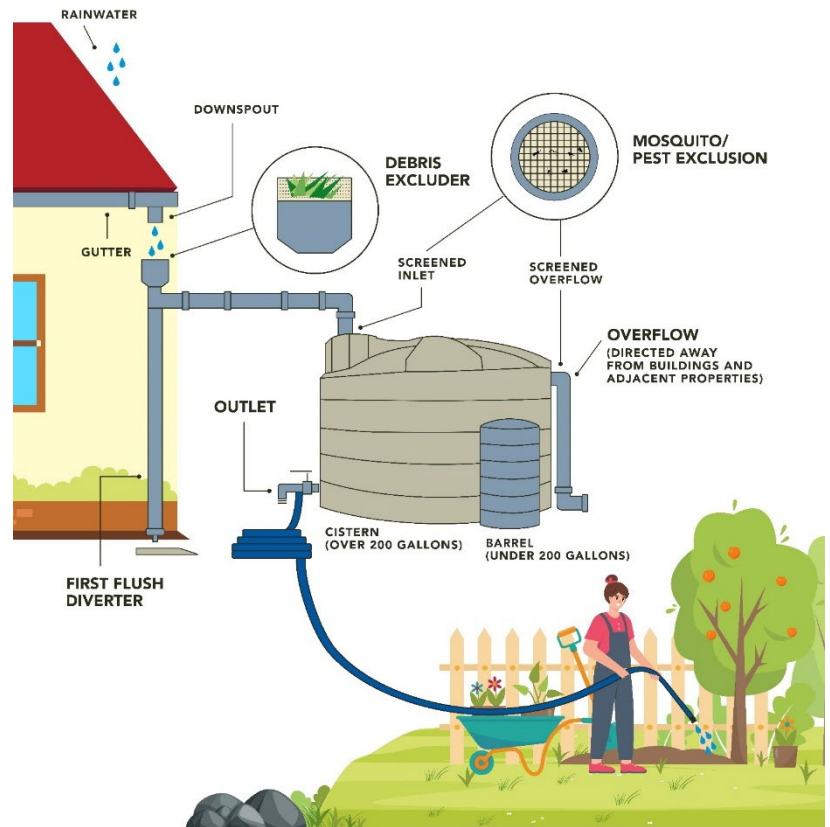
- Reducing the amount of rainwater leaving your property when it rains.
- Using a tank as surge protection to reduce flooding around your property.
- Saving rainwater to use for irrigating your garden and yard.

While these goals are overlapping, systems can be sized to prioritize different benefits. For example, reducing runoff can be prioritized by sizing tanks to collect around a 0.75 inch storm and planning to release that water slowly into the landscape between storms. Alternatively, sizing tanks to collect between 5 to 8 inches of rainfall across the rainy season can help you save a larger amount of rainwater to replace or offset irrigation with municipal potable water during the summer months.

Rain tank installation

Rainwater harvesting systems generally include the following components. Always follow manufacturer instructions for installation and comply with local building and plumbing codes. If you aren't sure, hire or consult with a qualified contractor.

- **Solid and level base** - The tank foundation should be flat, level, compacted and designed to support the weight of the tank when full. A 6 to 12 inch raised foundation can add space for placing a watering can under the spigot and will increase gravity flow from the tank.
- **Debris excluder or leaf filter** - This screened fitting is placed between the downspout and the tank inlet to filter out debris from the roof and gutters.
- **First flush diverter (optional)** - A first flush diverter directs the first portion of runoff from a rain event away from the rain tank and allows particulate matter to settle out.
- **Conveyance pipes** - To prevent the system from being overwhelmed, conveyance pipes need to be large enough to carry the amount of water moving off the roof and through the gutters during a large storm. For roof collection areas up to about 2,000 square feet, a 3-inch PVC pipe usually provides sufficient capacity. Avoid use of flexible downspout extension pipe which is not as durable and can hold small amounts of water that may foster mosquitos.
- **Safe overflow route** - The overflow pipe should be large enough to accommodate the flow of rainwater entering the tank and should be at least as large as the inlet pipe. Overflow from the tank must be directed away from buildings and adjacent properties. If you have space, you can direct overflow to a rain garden or swale so it can absorb into the ground. The [San Diego Sustainable Landscape Guidelines](#) describes how to build healthy soil and contour your yard to sink rainwater into the ground.
- **Mosquito exclusion** - All tank inlets and outlets must be screened (1/16th inch mesh or finer) to prevent mosquitoes and other insects from entering the tank. Screens must be fine enough to exclude mosquitos. Refer to the [County of San Diego's Vector Control Program](#) for more information on preventing mosquito breeding around your home.
- **Outlet/Spigot** - A full port valve (spigot) will reduce friction and increase water flow compared to a standard valve. Brass or stainless-steel valves are more durable than plastic valves.



Example rainwater harvesting system layout using a cistern or rain barrel.

Rain tank maintenance

- Prior to the rainy season:** check inlet and overflow screens to ensure they are intact and well-sealed; clean debris from your gutters and ensure the overflow pipe is intact and routes water away from buildings.
- Between rainstorms:** empty your first flush diverter (if you have one) and brush debris from your leaf filter. After each storm, use the water in your rain tank to water your garden or slowly release the water into your landscape. This helps to create space in the tank to collect more rainwater during the next storm. Consider limiting the release of water towards the end of the rainy season so that your tank remains full heading into the summer months.
- During dry periods:** use the water in your cistern to water your plants! Regularly check that mosquito screens are attached and well-sealed.

Where to use collected rainwater

Have you ever noticed how your yard perks up after it rains? Plants LOVE rainwater because it has a low salt and mineral content, is free of chlorine and has a slightly acidic pH that is ideal for many plants and is supportive of soil microbiology. These plants include California native plants, succulents, orchids, houseplants, fruiting trees and vines, vegetable gardens, acid loving plants like blueberries, and salt sensitive plants like avocados.

Note that if you decide to use rainwater to irrigate edible plants, it's recommended to water the soil directly rather than the edible parts of the plant. Roofing and materials that accumulate on roofs (like bird droppings, particulate matter, bacteria, and organic matter) may contaminate the rainwater. Releasing rainwater directly into the soil reduces direct contact between the pollutants and edible parts of the plant.



Rebates are available!

The City of San Diego offers rebates for the following:

- **Rain barrels/cisterns**
- **Downspout redirects**
- **Rain gutters**

For more information and to check eligibility, please visit WasteNoWater.org or ThinkBlue.org

Additional indoor and outdoor water conservation rebates, including rebates for rain barrels and cisterns, are offered by Metropolitan Water District of Southern California. Visit SoCalWaterSmart.com for more information.

Additional resources

Rainwater harvesting information:

- *Rainwater Harvesting for Drylands and Beyond Volume 1 and 2* by Brad Lancaster (available from City of San Diego Public Library system)
- *The Water-Wise Home: How to Conserve, Capture, and Reuse Water in Your Home and Landscape* by Laura Allen (available from City of San Diego Public Library system)
- San Diego Sustainable Landscape Guidelines: https://www.sandiegocounty.gov/content/sdc/dpw/watersheds/residential/San_Diego_Sustainable_Landscape_Guidelines.html
- American Rainwater Catchment Systems Association: www.arcsa.org
- Be Water Wise: <https://www.bewaterwise.com/toolkit.html>

Sourcing Materials:

- Rain tanks can be purchased from local tank supply stores, garden centers, rainwater harvesting contractors, and online distributors.
- Irrigation supply stores will usually carry 3-inch SDR-35 PVC pipes and fittings used for conveyance pipes, valves and components needed for a first flush diverter, and spigots.
- Home improvement stores carry gutter supplies as well as landscaping blocks, gravel and lumber for building tank bases.
- Online rainwater harvesting suppliers carry more specialized fittings such as leaf filters, screened inlet baskets, screened overflow fittings, and replacement parts for barrels and cisterns.

For more information on City of San Diego's pollution prevention and water conservation efforts, including rebates, please visit ThinkBlue.org or WasteNoWater.org

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