

# Cisterns

## In a Nutshell

A cistern is a device that captures and stores rainwater for reuse. Cisterns are typically made of concrete, plastic, polyethylene, or metal and are larger and more permanent than rain barrels. They range in size from 100 to 10,000 gallon capacities and can be placed underground, aboveground, or on rooftops. Cisterns are usually constructed in a traditional tank shape.

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## The “How To”

### Cistern General Information

Broadly defined, the word "cistern" means a tank for storing water. Cisterns can hold carried-in water or water caught from rainfall. In some places across the country, most notably rural areas without infrastructure, water is driven to locations by trucks and stored on the premises in a cistern. The majority of the content found within this Toolkit item refers to the type of cistern that catches and stores rainwater, but a lot of the concepts apply to both types. Cisterns are very similar in operation and functionality to [rain barrels](#), but rain barrels are much smaller.

Cisterns can often be included in comprehensive stormwater management plans. The Environmental Protection Agency, for example, includes cisterns on their list of Stormwater Management Best Practices and has implemented a large-scale [cistern system](#) at the EPA West building in Washington, DC.

Installed cisterns must be located near their catchment areas. If the cistern is to be built underground, the surrounding area can be graded and must be sloped away from the cistern in order to prevent contamination from surface water. The size of the catchment area can vary and depends mostly on the size of the cistern and the average rainfall in the community. Building roofs and guttering systems are typically used for catchments. If the water stored within the cistern is to be used for domestic purposes, like eating or drinking, then it must be chlorinated. If the water is only used for watering plants, washing cars, or flushing toilets, there are less-stringent cleanliness requirements.

Directly falling rainwater and water from a clean roof are best for reuse. Runoff from parking lots and sidewalks and standing bodies of water should not be reused, as this water is typically polluted. With proper authorization, underground cisterns may be built in areas with soils that drain well and may be approved to overflow into perforated pipes that drain under the property. If the surrounding soils do not drain well, the water is often required to overflow into a city system.

### Installation of Your Cistern

There are roughly four stages to installing a cistern. [Seattle Public Utilities](#) offers an informative document detailing the different steps. Not every project will follow the same steps in the same order, but the basic outline is generally applicable.

## Planning

- Decide that a cistern is appropriate for your location and situation
- Consider where the overflow will be discharged
- Contractors and engineers are available to design, plan, and build your cistern if desired
- Check local ordinances regarding cisterns and the allowable placement
- Acquire proper permitting for construction/plumbing/design, etc.
- Create the plan for the placement and construction of the cistern

## Shopping

- Look for the materials you plan to use; agricultural stores and farmers supply stores should be considered
- Shop around for the tanks; used ones will be cheaper, but the safest option is to purchase a new one
- Shop for pipe and connectors, screening, a drain valve, additional downspout materials, and other accessories

## Building

- Level the ground
- Build a level foundation
- Secure the tank
- Install a screened inlet
- Make gutter connections
- Install an overflow pipe
- Extend overflow pipe to a safe discharge location
- Install a drain valve

## Using

- Between October and May, leave the drain faucet partly open so the water can drain between storms
- In mid-May, close the drain so water is stored for summer applications
- Open the valve again in early October and repeat

## Maintenance of Your Cistern

The goal of a cistern is water storage and distribution, so all maintenance efforts should be aimed to maintain the standards of these two factors. Aboveground, visual inspections can provide a lot of information regarding the condition of the cistern and all accessories. Obviously, visual inspection is impossible if the cistern is underground. Some basic cleaning and maintenance items recommended by the [Seattle Public Utilities](#) are listed below.

- Maintain and clean your gutters/catchment areas
- Check and clean leaf diverter and screen
- Check for algae and sediment at the end of the season and clean as necessary
- Check valves and orifices
- Check condition of discharge/overflow/soaker hose and replace/repair as necessary

# Planning & Zoning

## Municipal Incentives

St. Louis Metropolitan Sewer District's Project Clear program awards [rainscaping grants](#) for projects including rain barrels and cisterns. For residents living in select municipalities within St. Louis County, the Deer Creek Watershed Alliance offers a [rainscaping cost-share program](#) for residents who wish to landscape their yards to improve stormwater management. Landowners must apply for the rebates and may select a variety of rainscaping options including installing a cistern, creating a [bioswale](#), planting a [rain garden](#), creating a [green roof](#), installing lawn alternatives, installing a [rain barrel](#), or amending soil. Some practices, such as rainwater harvesting, qualify for rebates but must be accompanied by a plant-based solution.

## Regulation Considerations

Regulations and policies regarding cisterns vary greatly depending upon location. Policies tend to relate to the manner in which water is collected and harvested and also how the collection system is connected to the various fixtures within the household. For example, water used for domestic purposes has higher quality requirements than water used for irrigation. Residential systems like [rain barrels](#) may require less planning and permitting, whereas large commercial cistern systems will most likely involve plan review and permitting.

Permits needed to install the system might include:

- Plumbing permit for rainwater harvesting systems
- Electrical permit for the pump or other electrical controls
- Building permits for cistern footings, foundations, enclosures, and roof structures
- Grading permits for erosion control and land development

Other considerations for the building a cistern may include:

- Zoning restrictions
- System component requirements
- Inspections and testing requirements
- System maintenance requirements

## Regulations in Other States

Various cities and states throughout the country have clearly-defined laws and regulations relating to cisterns. Below is just a sample of these regulations.

### Portland, Oregon

For residential use:

- Permit not required for outdoor use of harvested rainwater
- Permit required for indoor use of harvested rainwater
- Permit appeal must be filed before a homeowner can completely replace potable water with rainwater

For commercial/multifamily applications:

- Harvested rainwater must be treated with filters, UV light, or chlorine in order for it to be used to flush toilets

## Texas

The Texas Commission on Environmental Quality (TCEQ) has offered a [guide](#) for rainwater harvesting for public water systems. Selected regulations include:

- If rainwater is planned to be used as a source for drinking water, TCEQ must be notified in writing
- The collection, storage, treatment, and distribution facilities must be designed by a professional engineer licensed to practice in Texas
- All public water systems that treat surface water must be supervised by a water works operator who holds a Class C or higher surface water license

## Montana

The Montana Standards for Cisterns for Individual Non-Public Systems are listed in [Circular DEQ-17](#). Selected laws include:

- Cisterns must be located 10 feet from any foundation
- A water tightness test must be performed before any cistern can be put into service
- The access to all cisterns must be a minimum of 24" in diameter
- It is highly recommended that cistern water be sampled annually for bacteriological contents

# Dollars & Cents

There are many factors, some of which are listed below, that can influence the cost of your cistern. Generally, the cost will span from \$250 for a smaller cistern all the way to \$5,000 for a larger one.

## Factors Affecting the Cost of Your Cistern

- Size and capacity of cistern
- Material used to construct cistern
- Accessories necessary for cistern use (valve, piping, etc.)
- Creation/installation of catchment area (new gutters, screens, longer gutters, etc.)
- Creation/installation of discharge/soaker hose
- Grading/installation of secure base on which to put the cistern, if aboveground
- Digging hole/ditches to put cistern underground

# Measuring Success

## Continued Success of Your Cistern

The individual success possible from your own cistern is dependent upon two major factors. First, there has to be rainfall. If there is no rain, your cistern becomes a storage tank of nothing. If you build a cistern in a location that receives very little rainfall throughout the year, you will need to pay close attention to how often water is being used out of the supply. Second, the cistern has to be maintained in order to continue to function adequately and appropriately. If the valve is broken, water will not flow as intended. If the catchment screen is

clogged, water will not flow into the system. If the cistern is cracked, water will leak out and will not be available for use. Although you cannot control the amount of rainfall, you can control the ability of your cistern and accessories to operate successfully and efficiently.

## **Success of Widespread Cistern Usage**

The largest proponent of cisterns tends to be people who already have them or people interested in sustainable water practices. Advocacy and promotion of cisterns are crucial to the success and relevance of their use. Information about cisterns needs to be passed and promoted from one person to the next and from organizations to residents in order for more people and organizations to use them.

## **Measurable Success**

Listed below are some examples of where success of a cistern can be measured.

- Individual usage of water through the meter before and after the installation of your cistern
- Erosion before and after the installation of your cistern
- Number of households using a cistern
- Total amount of water purchased by a city before and after the installation of many cisterns throughout the city

## **Discover More**

The [Missouri Botanical Garden](#) provides resources on rainscaping and general environmental practices for conserving rainfall from the stormwater management system.

A resident of the [Dancing Rabbit Ecovillage](#) in Rutledge, Missouri built his own cistern and thoroughly documented the steps and thoughts involved during construction. Step-by-step construction processes along with tips for better future success are offered.