



# City of San Diego

## Rainwater Harvesting Guide



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## SECTION 1: INTRODUCTION TO RAINWATER HARVESTING

Rainwater harvesting is a technique dating back to the Greek and Roman empires, where sophisticated collection and storage systems were used to capture rainwater for a variety of domestic and agricultural uses. As civilization became more urbanized and the demand for quantities of purified water increased, water supplies became centralized and were distributed through a modern network of pipes. Until the last decade, rainwater harvesting systems were not commonly used in the United States as a means for supplementing piped water because of the perception that fresh, clean supplies of water would always be in abundance. With increased pressure on our water sources to support a growing population, escalating agricultural demands, and increased energy production, there is renewed interest throughout the United States, and especially in the southwestern part of the country where water is more scarce, in supplementing our water supplies through the capture and reuse of rainwater.

Very simply, rainwater harvesting is the capture, diversion, and storage of non-potable water for later reuse. Currently, rainwater harvesting in the United States is predominately used to provide water for non-potable activities, such as for landscape irrigation, decorative ponds, and car washing. Rainwater harvesting is a simple water conservation method that contributes to sustaining a healthy environment by decreasing the amount of storm water that can flow across polluted surfaces (such as roadways), picking up dirt, oil, grease and other contaminants before it finally ends up in our creeks, streams, and ocean. Reducing the amount of rainwater that enters the storm water conveyance system also helps prevent erosion of creeks and streambeds, and aids in protecting the diverse ecosystems that exist in southern California.

### WATER CONSERVATION

Very few local water supplies exist in San Diego County, and, as a result, 85 to 90 percent of our drinking water comes from the Colorado River and the Sacramento Bay Delta. Because our supply of water is subject to uncertain conditions, such as drought and regulatory restrictions, San Diego community leaders and water suppliers (such as the City of San Diego Public Utilities Department) have been developing water conservation plans and policies in recent years to ensure that we can continue to meet our water demands. Among the many recommendations

contained within these newly enacted policies is the use of rainwater harvesting systems.



Dry creek beds can be used during wet weather for infiltrating rain water.

Many of us enjoy green lawns, beautifully landscaped yards, and fresh produce from our backyard garden. But did you know that in many communities, 30 to 50 percent of the total water usage is used for landscape irrigation? Harvesting rainwater through a simple collection system for reuse on lawns and gardens decreases the burden on our valuable, and limited, potable water supply. Reusing rainwater can also result in a savings on our water bills and enhance our awareness of the value of water.



The City of San Diego's Water Conservation Program was created over 20 years ago in response to a need to address the chronic drought conditions in California and the decreasing available water supplies for southern Californians. The website for this program (<http://www.sandiego.gov/water/conservation>) contains valuable information on conservation resources, how to report instances of water waste, as well as rebate and incentive programs. In addition, a section of the website is dedicated to rainwater harvesting (<http://www.sandiego.gov/water/conservation/rainwater.shtml>).

### RAINWATER HARVESTING

Southern California is considered a "Mediterranean climate", which means that rainfall is not abundant. San Diego receives an average of only 10 inches of rain each year. Today, as our city has continued to grow at a rapid pace, undeveloped land has been replaced with impervious surfaces such as streets, buildings, and paved parking lots. More than 55 percent of the rain that falls is transported over contaminated surfaces, such as streets and parking lots, and then enters the storm water conveyance system through storm drains. This contaminated rainwater ultimately is released into creeks, streams, and the ocean. Rainwater harvesting systems provide us with an opportunity to increase the return of less contaminated rainwater back into the environment.

Although rainwater can be captured from many types of impervious areas (rooftops, driveways, roads, etc.), this guide focuses on harvesting rainwater exclusively from rooftops. Rooftop rainwater can be directed to gardens and other landscaped areas or captured in rain barrels for use later. Water not used by plants and trees seeps back into the ground slowly and is naturally filtered. When rainwater is put directly back into the environment rather than entering the storm water conveyance system, this water also recharges our natural sources of groundwater. An additional benefit to capturing and reusing rainwater is the reduction of erosion which can damage creek beds, natural open spaces, and hillsides.

A typical residential rainwater harvesting system consists of a few basic elements:

- ✓ a collection area (usually a roof);
- ✓ a system to capture the water (gutters and downspouts);
- ✓ a system to distribute the water;
- ✓ a system to filter the water (can be optional); and
- ✓ a storage tank (can be optional);

Rainwater harvesting is most beneficial when the amount of rainwater collected is similar to the amount of water needed for its intended use. State and local regulations prevent the use of rainwater for reuse as drinking water; therefore, this guide focuses on the reuse of captured rainwater for outdoor uses only, mainly landscape irrigation. Please note that the City of San Diego requires permits for the reuse of rainwater for indoor non-drinking water



Decorated Rain Barrel in an elementary school

### Did You Know?

Rainwater harvesting can reduce your water bill. Approximately 600 gallons of rainwater can be harvested from one inch of rain falling on a 1,000 square foot roof.



activities, and this guide does not address permitted activities for uses of rainwater. If you would like to pursue other uses for stored rainwater, please contact the City of San Diego’s Development Services Department regarding the various permit requirements at 619-446-5000 or visit their website at [www.sandiego.gov/development-services](http://www.sandiego.gov/development-services).

**PURPOSE OF GUIDE**

The purpose of this guide is to provide information that you can use to evaluate rainwater harvesting options and resources to install rain gutters, redirect downspouts, and use rain barrels for rainwater harvesting. There are several techniques presented in this guide that can be used to conserve water and to harvest rainwater for outdoor non-potable water uses, such as landscape irrigation. Figure 1-2 provides a step-by-step flowchart to help you get started on your new rainwater harvesting system. Table 1-1 provides definitions of key terms used throughout this guide.

**DEFINITIONS: TABLE 1-1**

<b>Infiltration</b>	The process whereby rainwater seeps into the soil, recharging the groundwater supply while also filtering the water through the layers of soil
<b>Impervious</b>	An area that does not allow rainwater to pass through to the soil beneath (e.g., concrete sidewalks, asphalt pavement, roof areas)
<b>Potable water</b>	Water suitable for drinking (humans or animals)
<b>Non-potable water</b>	Water not suitable for drinking (humans or animals)
<b>Downspout redirect</b>	A system that changes the way the downspout discharges water from a paved area or underground system to a landscaped area
<b>Eave</b>	The lower border of a roof that overhangs the wall (usually used in plural)
<b>Pitch of roof</b>	The steepness or slope of the roof
<b>Energy dissipater</b>	A device or material used to slow down the speed of water from a downspout as it exits onto the ground preventing erosion.

**Did You Know?**

The City of San Diego’s Water Conservation Program [website](#) has information regarding other ways you can reduce your water usage!



Figure 1-1



Section 2 of this guide provides information on how to determine how much rainwater can be collected from your roof and how much water you need for irrigation. Section 3 of the guide describes the first step to rainwater harvesting, which is collecting water from the rooftop. After the gutter and downspout locations have been planned or installed on your roof, the next step is to determine if downspout redirection (Section 4) or rain barrels (Section 5) can be used for rainwater harvesting.

Figure 1-2

<b>STEPS</b>	<b>1</b>	<p><b>Gutters and Downspouts</b> Does your house have gutters?</p>	<p><b>If yes</b>, then go to Step 2!</p>	<p><b>If no</b>, install gutters and see Section 3 of the Guide</p>
	<b>2</b>	<p><b>Direct Downspouts to a Landscaped Area</b> Where do your gutters discharge?</p>	<p><b>To landscape or rock infiltration area?</b> Congratulations go to Step 3!</p>	<p><b>To the driveway, patio, underground pipe system, or other impervious area?</b> See Section 4 of the Guide</p>
	<b>3</b>	<p><b>Store Rainwater for Future Use</b> Do you...</p>	<ul style="list-style-type: none"> <li>✓ have a greater need for landscape water? <b>Yes!</b></li> <li>✓ want clean, free water for an organic garden? <b>Yes!</b></li> <li>✓ have a pond or other outdoor water use? <b>Yes!</b></li> <li>✓ want to reduce your irrigation water bill? <b>Yes!</b></li> </ul>	<p><b>Install a Rain Barrel!</b> See Section 5 of the Guide</p>



## SECTION 2: IDENTIFYING WATER REQUIREMENTS

The two main factors that need to be considered when determining the size of your rainwater harvesting system are: 1) the amount of water that will run off your roof area and 2) the amount of water you need for irrigation and outdoor use. Information on how to calculate these two factors is provided below.

### ESTIMATING THE VOLUME OF RUNOFF FROM YOUR ROOF SYSTEM

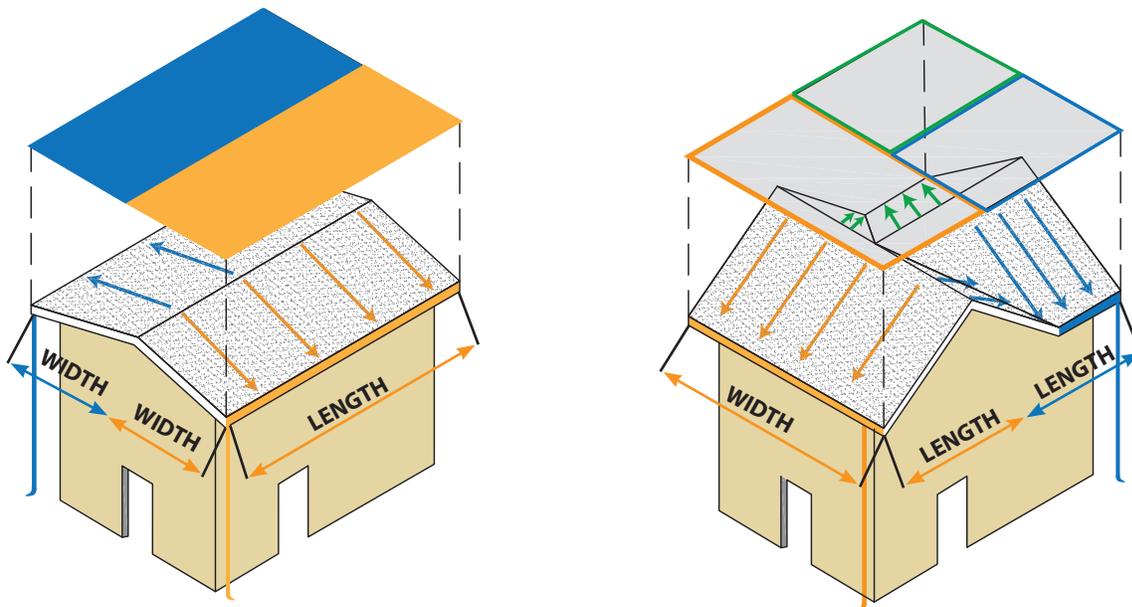
Hydrologists are professionals who study the earth's water systems and analyze rainfall patterns, micro-climates, land uses, and soil types in an effort to predict the amount of rainfall that runs off of surfaces during a storm event. The hydrologists developed a simple formula specifically for this guide to help you determine how much water is likely to be generated from your rooftop by a typical San Diego area storm. The formula to estimate the water running off the rooftop is as follows:

$$\text{Runoff (in gallons)} = 0.25 \times \text{Roof Area (in square feet)}$$

This formula is based on a typical San Diego area storm that produces approximately 0.6 inch of rain. Please note that this is an average storm; some storms will be smaller, producing less runoff, and some will be much larger, producing significantly more runoff.

The roof area in the equation above refers to the footprint of the roof. This means that the pitch of the roof is not considered when calculating the area and the length of the roof. The width of the roof should be measured from eave to eave and front to back. Figure 2-1 shows further clarification on how to determine your roof area. **Only the area of the roof draining to the gutter which connects to the downspout should be considered. This calculation will need to be repeated for each downspout connected to a rain barrel system.** For example, the orange roof area drains to the orange gutter/downspout.

Figure 2-1





### ESTIMATING QUANTITY OF WATER REQUIRED FOR IRRIGATION

In order to determine the amount of rainwater needed for irrigating your yard, you will need to evaluate the landscaped areas where the collected rainwater will be used, and determine the quantity of water needed for those areas. You should consider how often you water these landscaped areas and the amount of water you have needed in the past, on average, for the various types of vegetation in your yard. A helpful guide to estimate the water needed for landscaping can be found in the 2010 edition of the University of California Davis Arboretum All-Stars brochure, the [Water Use Classification of Landscape Species Reference \(WUCOLS\)](#). You can also use Table 2-1 to estimate the monthly summer and winter water use based on the type of vegetation in your yard and the area where your home is located.

Table 2-1 Landscape Water Needs

LANDSCAPE PLANTING TYPE	GENERAL WATER NEEDS CATEGORIES	WATER NEEDS (GALLONS PER SQUARE FOOT PER MONTH)	
		SUMMER (COASTAL-INLAND)	WINTER (COASTAL-INLAND)
Native/Adapted/Drought Tolerant	Low	.04-1.1	0.0-0.1
Succulent/Cacti/Xeriscape	Very Low/Low	0.1-0.7	0.0
Garden Ornamental	Moderate	1.4-2.1	0.1-0.3
Tropical	High	2.5-3.2	0.2-0.3
Turf (Traditional)	High	2.5-3.2	0.2-0.3
Turf (Buffalo Grass)	Low	0.4-1.1	0.0-0.1



Garden Ornamental Planting



Native/Adapted/Drought Tolerant Planting



Tropical Planting

Examples: In the summer, a home located in Pacific Beach (coastal) with 100 square feet of traditional turf (2.5 gallon/square foot) would need 250 gallons every month. In the winter, a home located in Rancho Bernardo (inland) with 100 sf of tropical landscaping (0.3 gallons/sf) would need 30 gallons of water each month.



### SECTION 3: HOW TO COLLECT ROOFTOP RAINWATER

Now that you know how much runoff from your roof will be generated during a typical rain event, and how much water your landscape needs, the next step is to design an effective rainwater collection system. Gutters and downspouts are the basic tools used to collect rainwater from a rooftop and direct it to the ground. The following section provides information regarding adding gutters to a home and locating where the downspouts should be placed to discharge the rainwater.

#### RAIN GUTTERS

Rain gutters are the easiest way to collect rainwater from the rooftop. Rain gutters are typically installed just under the edge of the roofing material and are connected to a downspout opening that conveys the collected water from the rooftop to the ground surface.

#### Basic Components

Rain gutters come in a wide variety of shapes, styles, and materials. Aluminum and steel are common materials used, but the size, style, and age of your home will determine the type of rain gutters that will work best for you. The City of San Diego discourages the use of copper rain gutters and downspouts because dissolved copper is a common water pollutant and copper gutters and downspouts can contribute to this problem. See Figure 3-1 for an illustration of the typical components.

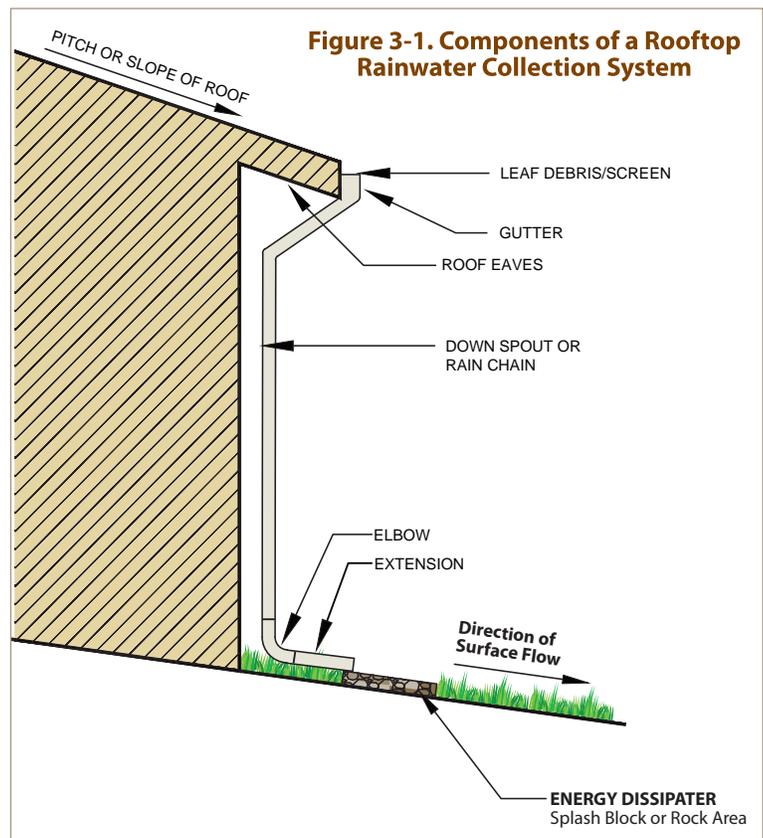
#### Did You Know?

Adding gutters to your home when re-roofing can simplify the installation process as gutters are more easily integrated into the whole roofing system when installed at the same time the roof is installed.

Your rain gutters should be protected from falling leaves and other vegetation. Debris protection systems should be considered when installing gutters. Adding debris screens, hoods, or other similar devices can decrease the amount of maintenance required each year by preventing debris from entering the gutter and clogging both the gutter and downspouts. A professional installer can provide information regarding what types of screens can be used with various gutter systems.

#### Size and Installation Criteria

The size of the rain gutters and method of installation will depend on the shape of your house and preferences you have regarding style and desired features, such as screens or covers. The gutters need to be sloped in order to produce proper drainage, should not be flat, and should be sloped to drain to the downspout opening.





Products commercially available in home improvement stores should be adequate for most home applications. Additionally, many companies in San Diego County offer professional rain gutter installation services. For further requirements and information regarding rain gutter sizing and installation, please refer to the California Building Code, San Diego Municipal Code ([Ch. 14, Art. 5, Div.1](#)), and the Uniform Plumbing Code (Chapter 11 and Appendix D), or consult with an installation specialist.

## RAIN GUTTER DOWNSPOUTS

Rain gutter downspouts transport rainwater collected in the gutters to the ground level. Information regarding the components, sizing and location of rainwater downspouts is provided below.

### Basic Components, Sizing and Installation

The downspouts and gutters used at an individual residence typically are constructed of the same material (vinyl or metal for example). The size of the downspouts should be determined based on the potential for the downspout to clog, and should have a similar capacity to the gutter systems connecting to it.

Rain chains or other water features can also be used to guide water from the rooftop gutters to ground level. Rain chains are both functional and decorative. Copper is a common material used in the manufacturing of rain chains, but, as stated before, the use of copper material is discouraged by the City of San Diego since contaminants from the copper can leach into the storm water. Other materials, like aluminum and titanium, also are commercially available for rain chains and provide a decorative alternative to downspouts.



**Rain Chain instead of downspout on a San Diego structure**

For further requirements and information regarding downspout sizing and installation requirements, please refer to California Building Code, San Diego Municipal Code ([Ch. 14, Art. 5, Div.1](#)), and the Uniform Plumbing Code (Chapter 11 and Appendix D), or consult with an installation specialist.



## DOWNSPOUT LOCATION CONSIDERATIONS

The location of the downspouts is an important factor for determining where the captured rainwater will be safely directed or stored. Ideally, downspouts should discharge the rainwater to a pervious area where the water can infiltrate into the ground without causing ponding or erosion. Because a main focus of the City is to encourage water infiltration and minimize erosion, downspouts should discharge to areas with vegetation or that contain gravel or thick mulch. It is important to consider the use of a splash block to prevent erosion where water discharges at the bottom of the downspout. Splash blocks can be made of prefabricated plastic or concrete and are available at most home improvement stores. A rock area can also be used to protect the ground and slow down the rate of water runoff from the downspout.

### Did You Know?

**Adding gutters can prevent structural or water damage to your home by redirecting rainwater away from the foundation and patio.**

**Figure 3-2 Types of Energy Dissipators/Splash Blocks**



## MAINTENANCE

Rainwater harvesting systems do require some simple maintenance depending on the type of system installed. As a homeowner, you are responsible for conducting the required maintenance to keep the system working as intended.

Rain gutters and downspouts should be checked and debris cleared at least twice a year, just prior to and during the rainy season. Check the gutters during rain events for signs that water is backing up or overflowing from the gutter. More frequent maintenance may be necessary depending on vegetation and trees in the vicinity of the rain gutters. Many companies provide gutter cleaning services as another option for maintaining the gutter system.



## SECTION 4: REDIRECTING YOUR DOWNSPOUT

Redirecting downspouts can be an easy way to start rainwater harvesting. Downspouts can be redirected to a landscaped area to allow rainwater from the roof to infiltrate into the ground.

### BASIC COMPONENTS

Redirecting a downspout only requires a few simple tools. Downspout elbows, extensions, and splash blocks are the only parts needed to redirect the downspouts and begin enjoying the benefits of rainwater harvesting. See Figure 3-1 for an illustration of these components.

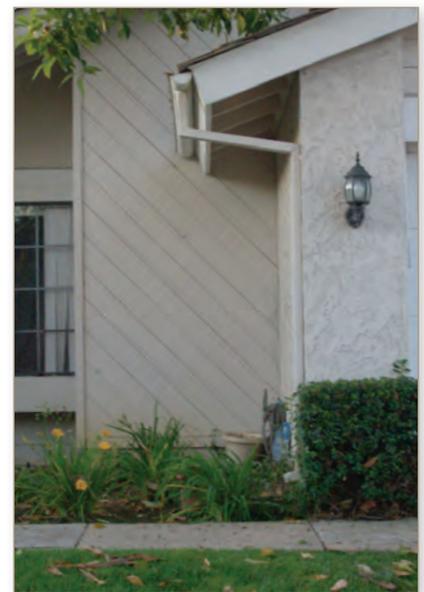
### PLANNING CONSIDERATIONS

Redirecting your downspout can be accomplished in a few short steps.

First, you should determine where the water from the downspout needs to go. The water from the downspout should be directed into a lawn or landscaped area, rain barrel, rain garden, or gravel areas that can accept the water transported from the roof area. It is important to evaluate whether the size of the landscaped area can accept and absorb the redirected water. A larger volume of water will be able to infiltrate into the ground if you select multiple landscaped areas, or other discharge points that are spread out over a large area. Please see Section 5 (Rain Barrels) if you are intending for the downspout disconnect to discharge to a rain barrel.

Second, you should determine how the water will get to the landscaped area. Water should be directed away from the foundation of the house to a vegetated area or gravel area near the downspout. The downspout needs to be close enough to the receiving area so that gravity will allow the water to drain from the downspout to the end of the extension pipe. Do not place the extension pipe on steep slopes as the water will flow from the pipe too quickly and cause erosion.

Third, you should select a safe path for water to drain (or overflow) during heavy storms. Once the selected vegetated area is saturated, and the soil can't absorb more water, excess water should be able to flow over the lawn, vegetated area, or gravel away from the house towards the storm drain system at the street without flowing onto a neighbor's property. One method of selecting an appropriate path for the runoff is to observe how water flows in your yard while it is raining, or with the garden hose running full force. A professional can also provide advice about how to set up your rainwater harvesting system.



**Redirected downspout drain into a landscaped area.**



Redirected downspout drain into a landscaped area.

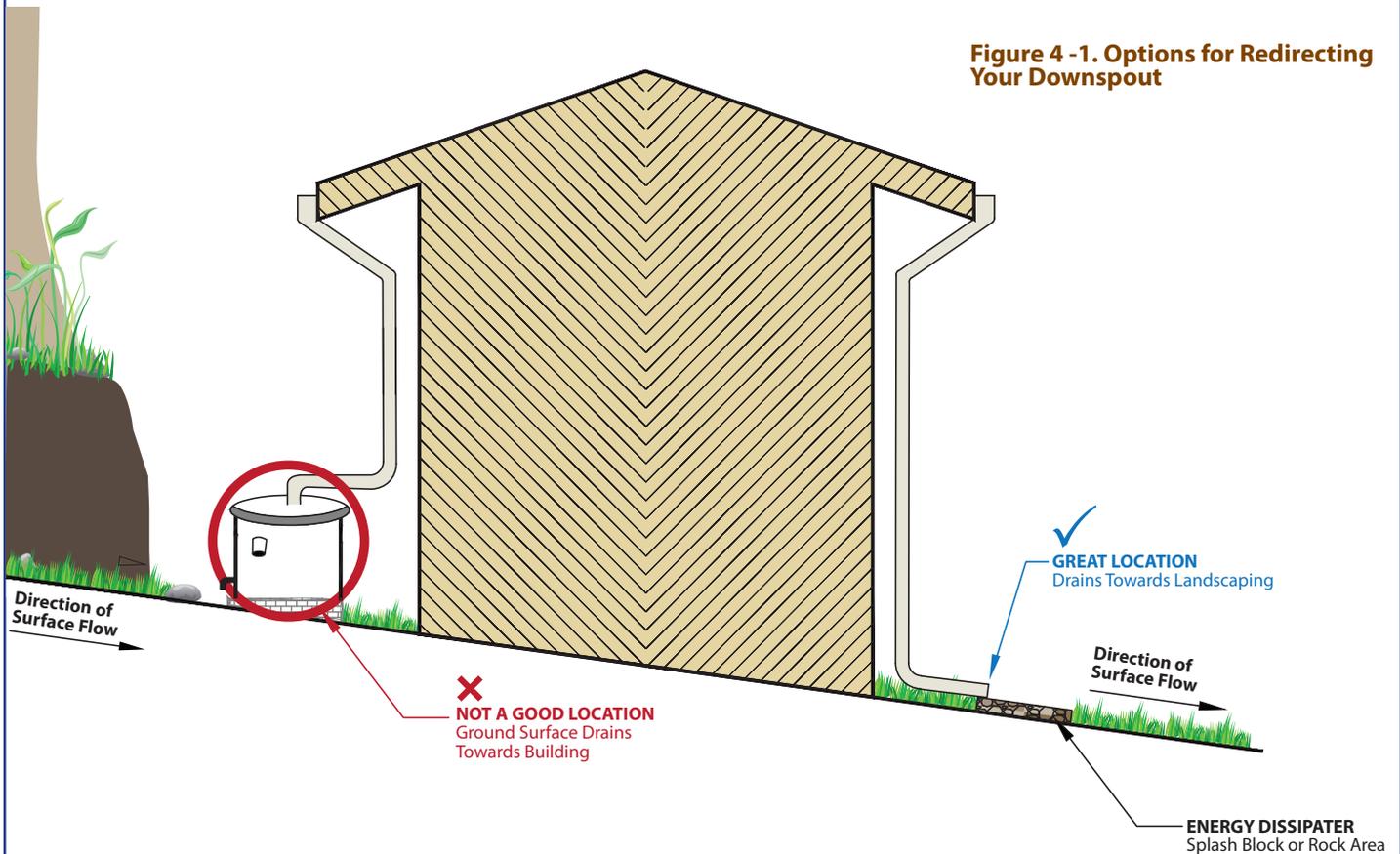
### LOCATING POTENTIAL DISCONNECTION AREAS

To determine if an area is a good place to disconnect the downspout, you should compare the size of the landscaped area (lawn, planter box, garden, etc.) with the volume of water that will be generated during an average storm using the procedures described in Section 2. For example, a planter box may be too small to handle the volume of water running off a large section of roof.

You should select a discharge point for the water that is a minimum of 5 feet away from the home and 10 feet from neighboring buildings. You can use a downspout extension to direct the discharge water where you want it to go. The ground area at the discharge point should slope away from any buildings to prevent erosion from occurring.

If the area you want to water is located a long distance from the house or on the other side of a private walkway, your downspout can be connected to a buried pipe that extends to the landscaped area. To ensure that the pipe drains well, a minimum slope of 1 percent from the building to the discharge point is recommended. See Figure 4-1 for more information on location considerations.

Figure 4-1. Options for Redirecting Your Downspout





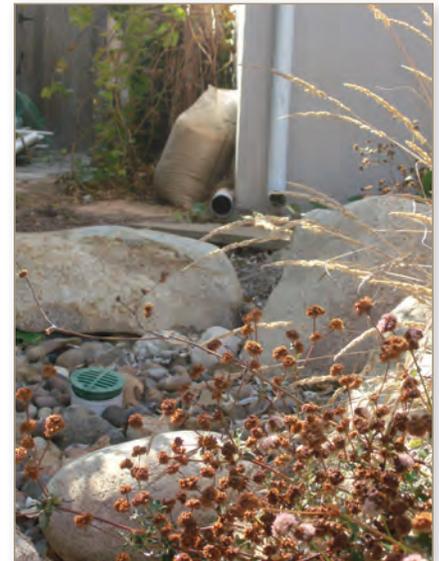
If possible, you should provide a way to help the water soak into the ground. A few ways to encourage infiltration are using compost amended soil, building a rock filled trench or french drain, or constructing a rain garden. If an area already has problems draining, it will not be a good candidate for roof drain redirection.

The velocity of the water coming out of the downspout will be high because of the drop from the roof to the ground and this can cause erosion to occur. Because of this, it is important for you to install an energy dissipater at the end of the downspout to prevent the ground from eroding. Energy dissipaters are simple to construct and can consist of a splash block, rock swale, or other similar material. See [Figure 3-2](#) for a few examples of energy dissipaters.

## OPERATIONS AND MAINTENANCE

After your downspout has been redirected, some regular maintenance will be required to keep the system operating as intended. You should check your system at a minimum on an annual basis, however, depending on the type of system you are using, more frequent maintenance may be necessary.

Refer to the maintenance requirements for the gutters and downspouts discussed in Section 3 for information regarding how to keep your redirected downspout in working order. It is important to make sure that your landscaped areas are handling the amount of water being directed there, and that any overflow is not running off onto your neighbor's property. You should confirm that the energy dissipater is in good repair and that you don't need to make modifications to the system to prevent erosion from occurring. It is important to follow the manufacturers specifications to maintain your system.



**An overflow drain was installed to keep water from overwhelming the landscaping during large storm events.**

## SECTION 5: RAIN BARRELS



**A 50-gallon rain barrel with overflow to a planter box.**

An alternative to redirecting rainwater from the roof directly to a landscaped area is to use a rain barrel to store the water. Rain barrels capture rainwater runoff from the roof and provide storage of the water for subsequent landscaping and other non-potable water use. Rain barrels come in a wide variety of shapes and sizes and are available for purchase, or you can make your own rain barrel as a do-it-yourself project. This guide focuses on aboveground rain barrels that drain by way of a hose or pipe without requiring pumps, and are not connected to your household plumbing system.

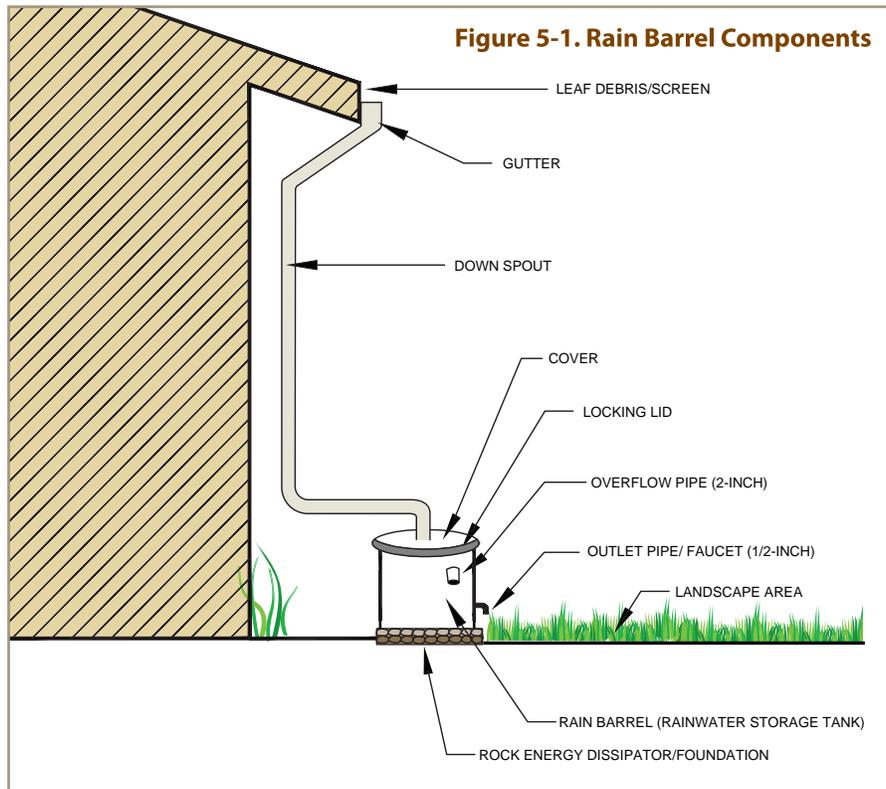


Using a rain barrel system allows you to store rainwater for use when it is not raining. The benefits of rain barrel use are described below.

- ✓ Reducing your dependency on the municipal water supply which reduces your water bill.
- ✓ Treating your garden, plants, and lawn to clean and free rainwater.
- ✓ Saving energy by reducing your demand on the City’s drinking water supply.

### BASIC COMPONENTS

A rain barrel system consists of a storage container, vinyl hose, PVC couplings, a screen grate on the inlet to keep out debris and insects, and an outlet faucet. Rain barrels are commercially available or can be made using a food-grade (appropriate for storing food) storage container. There are too many options regarding rain barrel systems to discuss in this guide, however, information regarding the basic configuration of a rain barrel and design alternatives are provided on the following figure.



### DETERMINING RAIN BARREL SIZE AND TYPE

The first decision to make is how much water you want to store. Section 2 of this guide provides information on how to estimate the water that will be collected from your roof and what your watering needs are for your landscaping. Once you determine these two factors, it is time to figure out the size of the rain barrel. There are many types, sizes and shapes of rain barrels on the market so you should be able to easily find the one that works best for your home should you decide to purchase a prefabricated barrel.



The amount of rainwater you can store will depend on the area you have available for placement of the barrels. Rain barrels take up space and are very heavy when full. It is unlikely that a single rain barrel will be sufficient to meet all your irrigation needs year round, but one or more rain barrels at different downspouts will help reduce your use of potable water, reduce your water bills, and help the environment!

For safety reasons, there are restrictions on the sizes and types of containers that can be used to store rainwater. Rain barrels that are not on the ground surface, that have a height that is greater than twice the width or that hold more than 5,000 gallons require a permit.

It is important that the quality of the water is not impacted by the barrel material you choose. Recycled containers used for water storage should not have stored chemicals. Used containers must be food grade and thoroughly cleaned prior to use as a rain barrel. The containers must be opaque and be made of ultra violet (UV) resistant material, or sun barriers must be used, to prevent the growth of algae. All materials used on the rain barrels should be manufactured for the intended use of the material. All pipes or plumbing materials used as part of the rain barrel system should be approved for use as a plumbing material.



**A variety of sizes and shapes of plastic rain barrels.**

## **WHERE TO PLACE YOUR RAIN BARREL**

Rain barrels can take up a large amount of space and be very heavy, so it is important to find an appropriate place for each barrel that will work on a long-term basis – so you don't have to keep moving the barrel. Barrels need to be placed on flat areas, near a downspout, and where the overflow from the rain barrel will not impact existing buildings or neighboring properties. You should also take into consideration the distance and elevation of the barrel from the landscaped areas to be watered.



### RAIN BARREL FOUNDATIONS

Rain barrels need to be placed on a sturdy and level foundation and be adequately secured. The weight of the rain barrel when it is full needs to be considered when determining the appropriate foundation. Fifty gallons of water weighs over 415 pounds, not including the weight of the container. If the surface on which the barrel is located is uneven or unstable, a full rain barrel may tip, releasing the water and potentially causing damage or injury as it falls.

Table 5-1 Weight of Water for Various Tank Sizes

SIZE OF CONTAINER (gallons)	WEIGHT OF WATER (pounds)
30	250
50	417
60	500
80	667
100	833

### RAIN BARREL OPENINGS

Any large openings in a barrel must be securely fastened and checked regularly to prevent access to the barrel. Even a small amount of water in a rain barrel is considered a drowning hazard. Thirsty birds and mice and curious children will be attracted to this water source. All openings must be screened to prevent mosquitoes from entering the barrel.



A recycled wood barrel on a sturdy foundation.



An overflow outlet is required on each barrel to prevent the water from overflowing the top of the barrel, and to prevent the gutter system from getting backed up and overflowing. The overflow of the barrel must discharge so that the water will drain away from any structures, not impact neighbors' properties, and be directed towards the



A 55-gallon rain barrel at San Ysidro Library.

nearest public street storm drain system. The area under the overflow should be protected to prevent erosion. The size of the overflow should be as large or larger than the downspout or inflow pipe. It is recommended the overflow size be at least two inches in diameter.

The inlet size will vary based on the design of the barrel. Inlets should be sized to allow the runoff from the downspout to enter the barrel. To minimize clogging at the inlet or outlets, gutters should be screened. The outlet or faucet should be placed no more than 6 inches above the bottom of the barrel.

### DETERMINING RAIN BARREL OVERFLOW

Once the amount of roof runoff is determined, as described in Section 2, check the difference between that volume and the volume of the rain barrel(s) to be used.

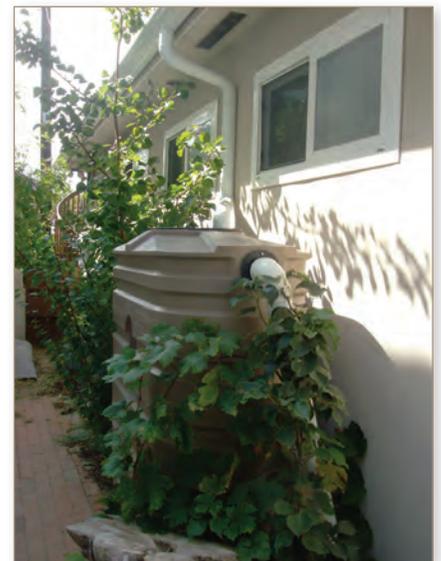
$$\text{Runoff (in gallons)} - \text{Rain Barrel Storage Volume (in gallons)} = \text{Overflow (in gallons)}$$

The above equation can be used to determine the expected overflow associated with a rain barrel, if any, assuming the barrel is completely empty at the start of a rainfall. If several storms come right after another or a large storm event occurs, the barrel can quickly overflow. The overflow outlet, under these conditions, becomes very important.

### OTHER RAIN BARREL PLANNING TIPS

When determining the type of barrel or system to use, additional items, described below, should be considered.

- If you live within a Homeowners' Association, you should verify where rain barrels are allowed before venturing too far into the design process. Some Homeowners' Associations may not allow rain barrels in front yards or may have specific requirements on what type of rain barrel is allowed.
- Your rain barrel system will require maintenance at least once a year. You should consider how to access the interior of the barrel to conduct maintenance when deciding what type rain barrel system will work for your home.
- Insects and other wildlife may try to gain access to the barrel, so it is important that the screens are checked regularly to prevent such nuisances from occurring.



A 300-gallon rain barrel with an overflow pipe that discharges to a landscaped area.



- If mosquitoes are an issue, consider using a mosquito dunk in the rain barrel. A mosquito dunk uses biological pesticides that kill the larvae before they mature. Mosquito dunks are also non-toxic to other wildlife, pets, and humans.
- When determining the foundation for the barrel, you should consider the location of the outlet or faucet. It may be beneficial to raise the barrel up on a stable block foundation so that you can get a watering can or bucket underneath.
- When selecting the location of the overflow outlet, you should consider which direction the water needs to flow away from the barrel. You should avoid having the overflow situated above the outlet/faucet for the barrel.
- To minimize the maintenance that will be needed for the rain barrel, you should consider using a pre-treatment device or a first flush device that attaches to the downspout and redirects the first portion of the rainfall, which carries the most debris and animal droppings from the roof, away from the rain barrel inlet. For additional information regarding a first flush device, you can conduct an internet search using the term "First Flush Device" to obtain ideas of how to find the pre-treatment device that will work best for your rain barrel system.
- You should also consider strapping the barrel, similar to strapping systems that are used on water heaters. Additional information on strapping can be found in the State of California's publication titled Guidelines for Earthquake Bracing of Residential Water Heaters .



**A 58-gallon decorated recycled rain barrel.**

## MAINTAINING YOUR BARREL

Rain barrels will require regular maintenance to keep them operational. The maintenance checklist for rain barrels is a little longer than for downspout redirection, however, most maintenance activities are only required annually. More frequent maintenance may be required, depending on the rain barrel system used and the location of your home.

### **Some of general operation and maintenance requirements are listed below.**

- The rain barrel needs to be emptied prior to storm events. One recommendation is to empty the rain barrel at the base of a tree or other deep-rooted vegetation prior to forecasted rain events.
- On a regular basis, you should check the rain barrel's screens for any holes, clogging, or other issues, and check that the lid is still on tight.
- Whenever the rain barrel overflows, and on a yearly basis, at minimum, you should check the flow path of the overflow water to make sure the water is not impacting any structures or neighboring properties on its path to a storm drain inlet.
- If there are erosion issues at the faucet or overflow, the energy dissipaters should be replaced or extended to stop the erosion.
- On an annual basis, you should use a non-toxic cleaner, like vinegar, to clean out the barrel. The barrel should be inspected for any leaks or holes at this time.



- If a manufactured rain barrel is used, you should follow the instructions provided with the product regarding the proper maintenance and operation of the rain barrel.

For additional information regarding rainwater harvesting, you can conduct an internet search using the term "Rain Barrel" to obtain endless ideas of how and where to store rainwater. The EPA provides a fact sheet with step-by-step instructions for a do-it-yourself project. Most home improvement stores provide rain barrel kits for installation. Other helpful resources for information on rain barrel suppliers are included on the County of San Diego and the City of Santa Monica rain barrel program websites. These websites, along with the EPA website, are listed below.

**EPA Fact Sheet:**

<http://www.epa.gov/reg3esd1/garden/pdf/make-rainbarrel.pdf>

**City of Santa Monica:**

[http://www.smgov.net/uploadedFiles/Departments/OSE/Categories/Urban\\_Runoff/Rain%20Barrel-Cistern%20System%20Suppliers.pdf](http://www.smgov.net/uploadedFiles/Departments/OSE/Categories/Urban_Runoff/Rain%20Barrel-Cistern%20System%20Suppliers.pdf)

**County of San Diego:**

[http://www.sdcounty.ca.gov/dpw/watersheds/residential/rain\\_barrel.html](http://www.sdcounty.ca.gov/dpw/watersheds/residential/rain_barrel.html)

**City of San Diego:**

<http://www.sandiego.gov/water/conservation/rainwater.shtml>



**A series of rain barrels used to capture rainwater.**