Rainwater Harvesting

We seldom consider the value of water. We simply turn on the faucet and safe, drinkable water flows into our glass. But as we continue to deplete aquifers, or draw more water from water reservoirs, we may soon learn the true value of water.

Rainwater harvesting is a viable water conservation concept. Simple systems are inexpensive and easy to maintain. Larger systems greatly reduce potable water consumption and can become a backup supply for fire suppression and earthquake preparedness. If we harvest rainwater for non-potable uses (landscape, toilet flushing, etc.), we reduce demand on our potable water supplier, and reduce our monthly water bill as well.

The most asked question is, "Just HOW do you harvest rainwater?" To the uninitiated, rainwater harvesting seems complicated, but in reality, it is simple. By placing a barrel under a shortened downspout, rainwater harvesting can begin. Larger systems require more thought, but once the concept is understood, even larger systems seem simple.

Green Building Benefits

- Rainwater harvesting reduces the need for imported water from the Sierras, the Delta, underground aquifers, and other sources. This conserves water for fisheries, wildlife, agriculture, and essential human needs.
- Rainwater is a superior water source for irrigation. The pH is slightly acid to almost neutral, so plants love it. Rainwater has neither dissolved minerals from the soil, nor chemicals from water treatment plants.
- Rainwater harvesting saves energy associated with delivering water from distant reservoirs and treating it to drinking water standards.
- Rainwater harvesting reduces stormwater runoff, which cuts down on erosion and reduces non-point source pollution. It protects our creeks, rivers, and estuaries from lawn fertilizer and pesticides, car oil, trash, and other pollutants that get washed into storm drains.
- Last but not least, you can reduce your water bill.

Affordability

How much does a system cost? Rainbarrels can be converted from surplus, non-contaminated drums. Purchased rainbarrels start at about $100. Larger cisterns start at 300 gallons and, depending upon the space available and restrictive covenants in effect, can be 1,000 to 10,000 gallons or more. The least expensive are made of polypropylene. Metal, wood and concrete are more expensive alternatives. Costs range from a low of about $0.50 per gallon for large fiberglass tanks to up to $4.00 per gallon for welded steel tanks. As tank sizes increase, unit costs per gallon of storage decreases.

Processing rainwater for potable uses is more complicated. If potable water is available from a centralized water system, potable rainwater systems are unnecessary, expensive and redundant. A potable rainwater system would never "pay for itself" if good, high quality water is available at the tap. However, it can be a financially viable alternative to digging a well.

Sizing

More than 60 gallons of rainwater can be collected off the roof of a 10'x10' garden shed in just a 1" rain. For 1,000 square feet of roof area, every inch of rainfall can produce up to 623 gallons of pure, clean rainwater.

To estimate the amount of water your catchment surface can collect, multiply the impermeable collection area's footprint (measured in square feet) by the rainfall in feet, then multiply the total by 7.5. The San Francisco area averages about 21.5 inches of rain per year (1.8 feet), which would yield almost 13,500 gallons of water per 1,000 square feet of roof "footprint" (the shadow of the roof, regardless of the pitch).

Regional rainfall is not distributed evenly over twelve months. Over 80 percent of San Francisco's seasonal rain falls between November and March, occurring over about 10 days per month. Rainfall from May through September is relatively rare, with an aggregate of less than an inch, or only about 5 percent of the yearly average total. So during the rainy season, there may be abundant rainfall when the storage containers are already full. During the dry season, the amount of water available to you will depend as much on your storage capacity as on the amount of rain the previous season. The Texas Manual on Rainwater Harvesting gives table

examples to estimate actual harvesting opportunities (see resources at end of fact sheet).

Installation

Regardless of the complexity of the system, the domestic rainwater harvesting system comprises six basic components:

- **Catchment surface** can be any type of roof surface when water is harvested for landscape irrigation. Metal roofs are very long lasting and work better than wood or composite shingles. Asphalt shingle, wood shingle, and tar and gravel roofs are acceptable for collecting irrigation water but should not be used for potable water because of toxins that can leach into the water supply.
- **Gutters and downspouts** channel water from the roof to the tank. The most common materials for gutters and downspouts are half-round PVC, vinyl, pipe, seamless aluminum, and galvanized steel. For potable water systems, lead cannot be used as gutter solder.
- **Leaf screens, first-flush diverters, and roof washers** remove debris and dust from the captured rainwater before it goes to the tank. A site with extensive tree cover may require some sort of leaf omitting device. Some method of discarding the first flush of rain from the roof is necessary to remove debris and accumulated dust and pollutants.
- **Storage tanks (cisterns)** must be opaque to inhibit algae growth. For potable systems, storage tanks must never have been used to store toxic materials. Tanks must be covered and vents screened to discourage mosquito breeding. Tanks used for potable systems must be accessible for cleaning. Black and green polypropylene tanks are available in most markets. Metal, wood, and concrete are more expensive alternatives when aesthetic considerations are important.
- **Delivery system** can be gravity-fed or pumped to the end use. Drip systems and soaker hoses need 15- 20 pounds per square inch (psi) of pressure to work correctly. Methods of irrigation like basin flooding or "T-Tape" (a drip system that functions on 2-10 psi) can be used for low pressure systems.
- **Treatment/purification** is required for potable systems to make the water safe to drink. Typical purification methods include charcoal filtration, UV light, ozonation, membrane filtration, and chlorination.

Operation and Maintenance

The key issue for operation and maintenance is keeping the system clean and leak-free. Proper system design to prevent impurities from entering the system will greatly simplify upkeep. For a nonpotable system used for hose irrigation, if tree overhang is present, leaf screens on gutters and a roof washer diverting 10 gallons for every 1,000 square feet of roof is sufficient. If drip irrigation is planned, sediment filtration may be necessary to prevent emitters from clogging. For potable water systems, the water should be filtered and disinfected to remove any disease-causing pathogens from stored water. System owners should regularly clean gutters and first-flush devices. In addition, owners of potable systems must adopt a regimen of changing out filters regularly, maintaining disinfection equipment, and regularly testing water quality.

For more information

- The Texas Manual on Rainwater Harvesting, methods, equipment, calculation tools http://www.twdb.state.tx.us/publications/reports/RainwaterHarvestingManual_3rdedition.pdf
- American Rainwater Catchment Systems Association, rainwater harvesting information, conferences http://www.arcsa-usa.org
- *Plants and Landscapes for Summer Dry Climates*, East Bay Municipal Utility District. http://www.ebmud.com/conserving_&_recycling/plant_book/default.htm
- The Watershed Project, examples of educational opportunities http://www.thewatershedproject.org
- Climate of San Francisco, Narrative Description http://ggweather.com/sf/narrative.html
- City of Portland, Oregon Rainwater Code http://www.bds.ci.portland.or.us/pubs/CodeGuides/Cabo/RES34%201.pdf
- Los Angeles Single-Family Demonstration Home with Cistern http://www.treepeople.org/trees/PBsite1.htm
- Domestic Use of Rainwater –The Next Home-Based Environmental Movement? http://www.rainwaterconnection.com/CIP2000.html
- For more information about the Coalition, visit our website at www.greenaffordablehousing.org or call Bruce Mast at 510-271-4785.

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