

## Collect Rainwater from Roofs

by *Guy Baldwin*

Many people in the U.S. express distaste over the thought of actually drinking water that has been collected from the roof. Immediate reactions vary from "What kind of chemicals do you get from roofing material?" to "What about bird droppings, dead bugs and leaves?"

An Australian visiting this country might well express the opposite reaction—surprise that people here actually drink water from the ground. This reaction is understandable when you consider how much we dump on the land in the way of pesticides, herbicides, toxic wastes, animal wastes, and human wastes from septic drain fields and sewage treatment systems. We are defecating in our water supplies, yet we wonder if rainwater is safe to drink. Still, groundwater remains the source of drinking water for most Americans, despite containing inherently more dissolved salts than rainwater—iron, magnesium, aluminum, nitrates, and heavy metal salts.

Worries over chemicals in rooftop water from asphalt, shingles, composition tile, or corrugated sheet metal may have some basis in fact, especially in areas where rain is highly acidic, yet when compared to the contaminants now found in many ground and surface water sources, rooftop water may be the safest available, and it is certainly a viable, low-cost alternative for self-reliance. From personal experience, the water I drank from roof catchment tanks in Australia tasted good. There was no need for water softeners to buffer the impact of "hard" water.

Australia is a relatively dry place. Most of the population lives in areas which receive 10 - 30 inches of rainfall annually, yet we found roof water was the primary source for drinking water and other household usage in a large percentage of homes in all areas we visited, from Queensland to South Australia to Tasmania.

In wetter areas fewer tanks are needed to store enough water. In dry areas, rural homes are often surrounded by a hodgepodge of 55 gallon drums, underground cisterns, small, medium, and large (50 to 50,000 gallon) tanks of wood, ferrocement, or corrugated iron. Even in urban areas some residents choose to install rainfall collection and storage systems rather than rely on municipal water supplies for drinking water.

One innovative system I saw serves as the sole supply for a small youth hostel in New South Wales. Two 2000 gallon tanks caught water from half the roof. (A lot of piping would have been needed to collect water from the other half.) Gravity flow from the tanks supplied the kitchen, cold shower, toilets, and washroom sinks. The largest water user—the shower—was hooked into a simple cut-off system (see illustration). Whenever the water level in the tank dropped below half-full, the shower ceased working, thus immediately putting water

conservation measures into effect until the next rain.

It is advisable to have two outlet pipes on any water tank (whether filled with roof water or from any other supply), one at the bottom—to drain the tank for maintenance—and one located at about half volume. The higher outlet will be used most of the time; if the tank springs a leak, or if there is a prolonged drought or other problem with supply, then a reserve supply remains available after the first tap runs dry.

Various methods of filtration can be used to keep roof debris from flushing into tanks, and to keep mosquitos and other insects from getting into the stored water. Simple systems exist to allow the first 50 or 100 gallons from a rainstorm to flush the drain pipes out, allowing only clean water into the tanks. Chemicals are rarely needed to keep the water clean.

In comparing the cost of construction of rooftop water storage to conventional systems, there are many instances where a roof runoff system will be much less expensive. Collection facilities (rain gutters, which many homes already have, plus plumbing) are a relatively minor cost, and should be designed into new structures as a matter of course. Tanks come in a variety of sizes and types and need to be sized according to water needs and climatic conditions. Ferrocement tanks can be constructed on site at low cost, and will be valuable whatever water supply system is used.

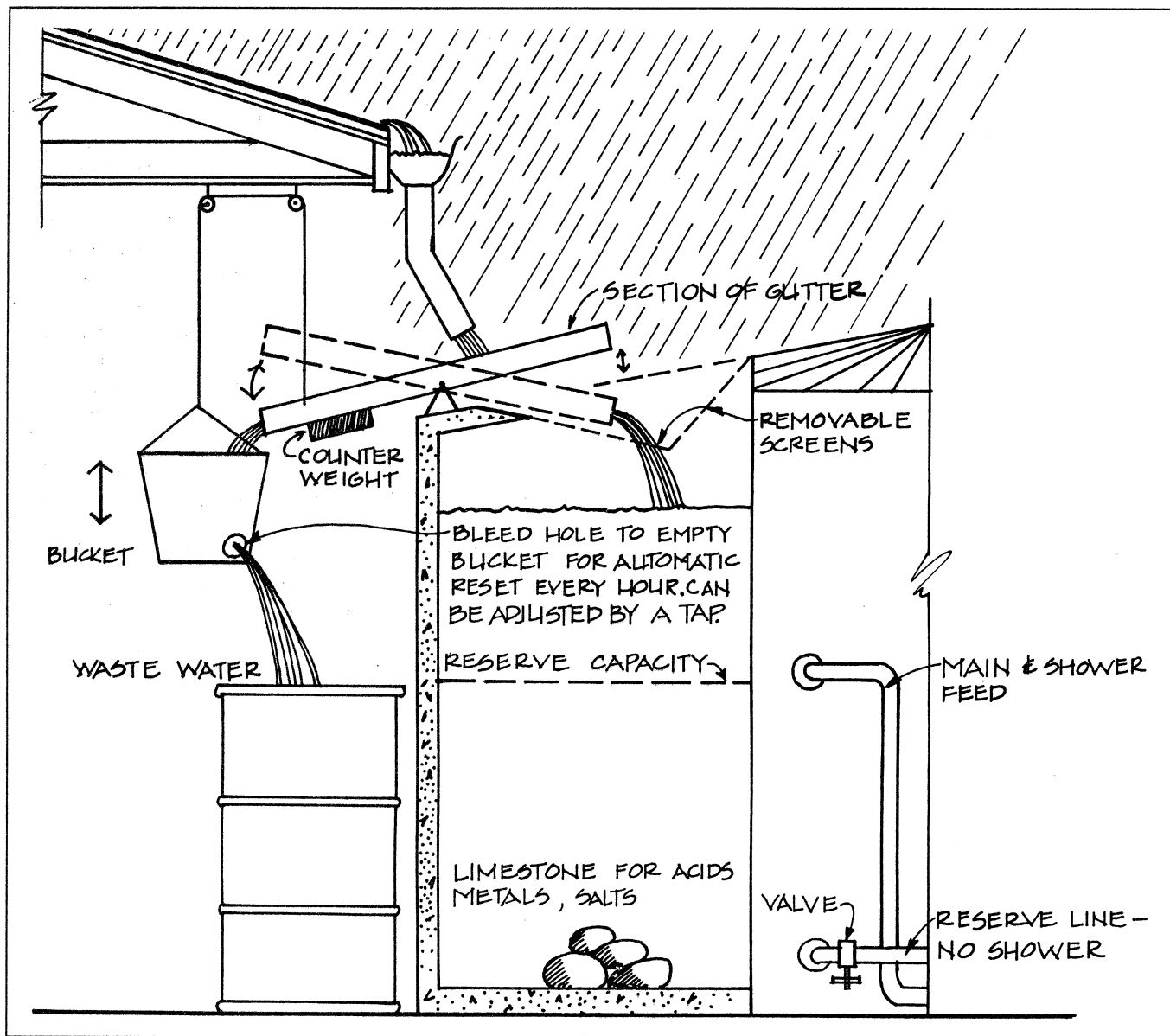
For many rural homesites, the conventional water supply system is a well and a submersible electric pump (unless you are lucky enough to have a safe, dependable source of surface water at a higher elevation than your house). The cost of putting in the well, pump, and power can be astronomical. Typical well installation costs are \$20/foot (200 foot wells are not uncommon), utility power can be brought in (\$11/foot from existing power lines in our area), or electricity supplied by photovoltaic panels (\$1000 - \$2000 for pump, panels, and tracker unit). A well-designed (i.e., expensive) submersible pump will last a long time (5 - 15 years), but they are mechanical devices and they wear out eventually. So do rain gutters, but they're a lot cheaper and they last longer.

As a rough example to demonstrate the feasibility of a roof-top system for drinking water supply let's consider the needs of a family of four in an area which typically has seven months with no rainfall. During the rainy season, the tank will fill up with each rain, so the critical period of time is the dry season. We'll estimate water use at 5 gallons per person per day (enough for drinking, cooking, cleaning, and a short shower every couple of days). How big does the tank need to be?

Total water use for 7 months:

$7 \text{ months} \times 30 \text{ days/month} \times 5 \text{ gallons/person/day} \times 4 \text{ persons} = 4200 \text{ gallons}$

So, we need a 5000 gallon tank (or larger to be safe).



**Rainwater collection system: bucket/pulley/weighted gutter arrangement diverts initial flush of dirty water, allowing only clean water to be stored in large tank. Shower cut-off on right side initiates water conservation measures when tank drops below half full. Illustration: Silvia Parsons, adapted from p. 166, *Permaculture: A Practical Guide for a Sustainable Future***

Remember, we are talking about household water. If you are trying to collect enough for garden irrigation, you'd better build a small pond or a very big tank, and collect water from a larger catchment than just the roof of the house.

Assuming a 2000 square-foot roof (house plus garage or shed), how many inches of rain will fill the tank?

5000 gal. divided by 7.5 gal./cubic feet = 666 cubic feet  
666 ft. divided by 2000 sq. ft. x 12 in./ft. = 4 in.

Thus, even in a dry climate, enough water can be collected from a moderately sized roof to fill a tank to last seven months. If any rain at all falls during this period, the tank will get a boost and there will be a greater safety margin. In drier climates, storage tanks must be sized larger to get through the dry season, and will have to store a larger percentage of the total annual runoff. Another alternative is to expand the collection area by collecting runoff from the barn roof, or a paved area, or a large rock or hard surface.

#### Resources:

1. *Ferrocement Water Tanks and their Construction*. S.B. Watt, Intermediate Technology Development Group, 1978.
2. *More Water for Arid Lands*. National Academy of Sciences, 1974. Collection, storage, use, re-use, and conservation of water for domestic, garden, and large-scale irrigation.
3. *The Owner Built Homestead*, Barbara and Ken Kern.
4. *The Owner Built Home*, and *The Owner Built Home Revisited*, Ken Kern. Both cover use of thin-wall "slip form" for construction of cement tanks and other structures.
6. *Real Goods News* catalog. Real Goods Trading Company, 966 Mazzoni St., Ukiah, CA 95482. Carries water purification systems, 12 volt pumps and photovoltaic panels, trackers, and water tanks.

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