

Graywater Use for Irrigation

Graywater is defined as untreated household wastewater, which has not come into contact with toilet waste. This includes water from bathtubs, showers, bathroom wash basins, clothes washing machines and laundry tubs. It does not include wastewater from kitchen sinks, dishwashers, or laundry water from soiled diapers (from the California Graywater Standards).

The United States Green Building Council (USGBC), many green building programs, and the State of California encourage the installation and use of graywater systems. There are many benefits to “harvesting” graywater, but there are also challenges that must be addressed.

Green Building Benefits

Graywater recycling is a component of most green building rating systems. It offers several environmental and economic benefits:

- Graywater harvesting reduces the need for imported irrigation water from the Sierras, the Delta, underground aquifers, and other sources. This conserves water for fisheries, wildlife, agriculture, and essential human needs and reduces reduce your water bill.
- Graywater harvesting saves energy associated with delivering water from distant reservoirs and treating it to drinking water standards. It saves even more energy by avoiding the need to treat it prior to discharge. Energy savings translate into reduced air pollution from power plants.

Permitting Requirements

Installation of graywater systems in California is governed by Title 24, Part 5, of the California Administrative Code, which is established by the Building Standards Commission. All system installations require a permit. The codes set conditions on installation based on location, soil type, and ground water level. The code gives local jurisdictions authority to impose stricter requirements or to prohibit their use altogether.

Design Considerations

Graywater may be used for landscape irrigation, but in multifamily and nonresidential applications, extra consideration must be given for accidental contact with the graywater. Graywater should not be used in vegetable gardens. Indoors, graywater may be used for toilet flushing and air-conditioning makeup water.

Retrofitting a structure for graywater reclamation is difficult. In most cases, it should only be considered in a total rehab of an existing building, or in new construction. A graywater system usually consists of:

- **Plumbing system** made up of pipes and valves to bring the graywater out of the house. The sanitary sewer system will be split into two separate sets of pipes, with the graywater going to the surge tank. Because of the reduced liquid in the black water system, appropriate steps must be taken to ensure adequate drainage to the sanitary sewer, or backups will ensue.
- **Three-way valve** to permit diversion of contaminated or excess water to the sanitary sewer system
- **Surge tank** to temporarily hold large drain flows from washing machines or bathtubs
- **Filter** to remove particles which could clog the irrigation system
- **Pump** to move the water from the surge tank to the irrigation field
- **Irrigation System** to move the water to the plants, either a mini-leachfield or a subsurface drip irrigation system.

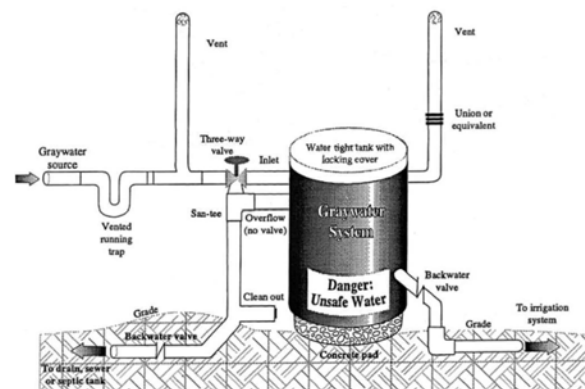


Figure 1. Graywater system components



Gray water systems must include sufficient irrigation area, given the type of soil and infiltration rate, to distribute all graywater produced daily without surfacing. To determine the amount of irrigation area you will need, first calculate the expected graywater volume using the formula prescribed in the building standards. Start by calculating the typical number of occupants for your home as follows:

- First Bedroom 2 occupants
- Each additional bedroom 1 occupant

Then estimate the daily graywater flows for each occupant:

- Showers, bathtubs and wash basins (total) 25 Gal./Day/Occupant
- Clothes washer 15 Gal./Day/Occupant

Finally, multiply the number of occupants by the estimated graywater flow.

Number Bedrooms	of	Graywater (gal./day) ¹	flow
1		80	
2		120	
3		160	
4		200	

For a given graywater flow rate, the Gray Water Standards sets minimum required irrigation area for six different soil types. In some cases, the local jurisdiction may require a percolation test to determine the required area.

Cost Considerations

On average, up to 40 gallons per person of graywater is available to be recycled on a daily basis. Although this is a lot of water, the cost of potable water today is still relatively inexpensive. It will generally take many years to recoup the initial cost of a graywater system.

With the adoption of stricter plumbing code requirements, toilets now operate at 1.6 gallons per flush or less, faucet aerators reduce water flow to 1.5 gallons per minute or less, and quality, high-performance water-conserving

¹ Prescribed flows per the California Graywater Standards, assuming graywater collection from showers, bathtubs, wash basins, and clothes washer.

shower heads are available. As a result, the amount of graywater available to “harvest” has been greatly reduced.

Operation and Maintenance

Graywater reuse requires extensive, ongoing education. In multi-family housing, this would require constant training for existing and new tenants. Most people have never experienced graywater harvesting, and would need and introduction to the benefits and requirements.

The Graywater Guide, published by the California Department of Water Resources, advocates four rules to follow when using graywater:

1. Don't drink or play in graywater.
2. Don't mix potable (drinking) water with graywater.
3. Don't allow anything that may be eaten to come into contact with graywater.
4. Don't allow graywater to pond on the surface or run off the property.

The same source recommends selecting garden-friendly soaps. “Most hand and dish soaps and shampoos will not damage plants at low residential concentrations. Laundry detergents, on the other hand, need to be selected carefully. Sodium and boron are chemicals that can have a negative effect on landscapes. Powdered detergents and soaps include ‘filler’ ingredients (not essential to clothes cleaning) which are usually some compound of sodium. Liquid soaps contain few fillers, thus less sodium. A few soaps are now being formulated for use with graywater systems.”

In general, you should avoid bleaches or softeners; detergents that advertise whitening, softening and enzymatic powers; and detergents with ingredients that include bleach, boron, borax, chlorine, peroxygen, sodium perborate, petroleum distillate, alkylbenzene, or sodium trypochlorite.

Graywater should not be stored for more than 24 hours without chlorination because bacteria growth will turn it “black” and produce odors.

Household members should understand how and when to use the three-way valve to divert graywater to the municipal wastewater treatment



system. Graywater should be diverted from the property's irrigation system when (1) the graywater volume exceeds the system capacity or the landscape irrigation needs or (2) when the graywater is contaminated with human fecal matter or toxics deemed detrimental to the landscape.

Examples of contamination events that call for graywater to be sent to the sewer include:

- Washing clothes laden with pesticides, vehicle lubricants, or other toxic chemicals
- Washing clothes with bleaches or softeners
- Washing diapers
- Unclogging a drain with chemically-based products
- Clean porcelain with products designed to clean without scrubbing

It is important to check your system on a regular basis, every week or so, to see that graywater is not surfacing, that the plants and soils are healthy, and that the equipment is working properly.

For more information

- California Graywater Standards, Title 24, Part 5, California Administrative Code, Graywater Systems For Single Family Dwellings
www.owue.water.ca.gov/docs/Revised_Graywater_Standards.pdf
- Graywater Guide
www.owue.water.ca.gov/docs/graywater_guide_book.pdf
- Oasis Designs
www.oasisdesign.net/greywater/index.htm
- The Irrigation Association, irrigation information www.irrigation.org
- For more information about Build It Green, visit our web site at www.BuildItGreen.org or call us at 510-845-0472.

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Figure 1 adapted from *Title 24, Part 5, California Administrative Code, Appendix G, Graywater Systems*, Building Standards Commission.