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Gray-Water Use & Trees

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Drinkable water becomes more valuable every year. Some communities restrict water use periodically, curtailing outdoor watering when shortages occur. Water restrictions can be disastrous for young, old, and valuable trees which depend upon irrigation to become established or survive. In times of water shortage, slightly used potable water can provide an alternative tree irrigation water source. Separating slightly used water (gray-water) from sewage (black-water) makes good conservation sense.

Gray-water is a water conserving alternative which merits a close look for tree use in times of drought, or for general tree irrigation. Homeowners and small service businesses tend to waste an average of 1/3 of drinking quality water delivered from wells or public water authorities. A major amount of this water is used for diluting toilet, sink and laundry wastes, and for rinsing hands, bodies, and clothes in sinks, showers and laundries. Every day many gallons of drinkable water are used for tree irrigation, which could employ gray-water.

Restricted!

It is important to note storing and surface applications of gray-water are against health codes in many counties and municipalities. Check with your local health department and/or state environmental water quality regulators for additional information about using gray-water for trees at your address. Also note, this information is for educational use, and does not constitute a gray-water system design or installation standard.

Water By Another Name

Gray-water was potable water which has already been used once, and which can be captured and reused. Gray-water includes: discharge from kitchen sinks and dishwashers (NOT garbage disposals); bathtubs, showers and lavatories (NOT toilets); and, household laundry (NOT diaper water). Using gray-water can greatly increase home water-use efficiency (+20% to +33%) and provide a water source for tree irrigation.

Unfortunately, many health regulations consider any non-drinkable water as black-water or sewage. Many plumbing and health codes do not accept gray-water for reuse because of health risks. For the legal status of gray-water in your community, county and state, consult your local building codes, health officials, sanitation engineers and pollution control officials. Many levels of government are now examining if and when gray-water could be used for helping with water conservation programs.

Would It Make A Difference?

Gray-water separation and use could conserve 20 to 33 percent of drinkable water for re-use. Community-wide gray-water use could allow a reduction in the size of water-purification and sewage-treatment facilities. Across the nation, toilet flushing and general landscape irrigation are major home uses for drinkable water. Therefore, the most effective use of gray-water is for flushing toilets and watering landscapes. Imagine water conservation benefits from using gray-water for these two purposes.

What's In It?

Gray-water composition depends upon water source, plumbing system, living habits and personal hygiene of users. Attributes of gray-water are impacted by cleaning products used, dishwashing patterns, laundry practices, bathing habits, and disposal of household chemicals. Physical, chemical and biological characteristics of gray-water, and when it could be used, varies greatly among families and service businesses.

Figure 1 provides an average home gray-water generation pattern. Figure 2 provides average characteristics of gray-water compared with total (combined) wastewater coming from a home. Notice at normal use concentrations, few materials in gray-water will damage trees if they are applied to a healthy soil. Also, few detrimental soil changes will occur from continuous, well managed gray-water applications.

Gray-water does have several unique characteristics of note -- grease, heat, and particles. Greywater usually contains large concentrations of oils and grease. Use of a grease trap, and remembering not to pour grease, oils or fats down the drain, minimizes these components. Gray-water is significantly warmer than normal wastewater streams by as much as 15°F. Gray-water also contains a large amount of fibers and particles. Filters must be used to remove these materials before gray-water enters soil or an irrigation system.

Avoiding Trouble

Some materials and water inputs should not be allowed to enter a gray-water collection system for use with trees. Items to avoid include: cleaners, thinners, solvents and drain openers; cleaning and laundry materials containing boron; artificially softened water (softening water replaces calcium and magnesium ions with sodium ions which can initiate severe soil and tree problems); and, drainage water from swimming pools and hot tubs (contains high salt concentrations, and a variety of chlorine and/or bromine compounds.)

Human Health Concerns

Properly treated and continuously monitored gray-water can be a valuable and safe resource for tree irrigation in landscapes. However, ignoring problems and not checking the system periodically can lead to human health and maintenance difficulties. Gray-water held for any length of time can build-up tremendous bacteria loads. Misused gray-water can spread typhoid fever, dysentery, hepatitis and other bacterial and viral problems. Disinfection is critical for gray-water held more than two (2) hours. Health hazards, especially eye contact and dermatitis problems arise from dissolved and suspended organic materials and detergents. To make it easy to identify and to prevent usage mistakes, a vegetable dye can be added to gray-water. In new installation or in a plumbing retrofit, use of colored pipes to identify lines carrying gray-water is useful.

Collect & Hold

There are three principal ways of collecting and holding gray-water in a household setting:

- 1) **Pot & Carry** -- Simply collect water from laundry rinses, sinks and baths by hand. This way of collecting, carrying, and applying gray-water has been used since ancient times. When water had to be drawn by bucket, many uses were made of each gallon.
- 2) **Plumbed Holding Tank** -- Gray-water can be piped (either in new construction or as a retrofit) from selected household drains to a holding tank. Gray-water from the shower, bathroom sink, or kitchen sink without a garbage disposal, can be carried in drain pipes into an aboveground, usually inside the house, holding tank.

This system uses gravity to move gray-water into the tank and a pump to remove it. The gray-water tank should be durable and non-corrodible. Never reuse containers for holding tanks which once held corrosive chemicals, wood preservatives, organic solvents or pesticides. Even minute traces of these chemicals might kill trees. Holding tanks will require an attached disinfection unit. Tank size depends upon available space and amount of gray water generated.

If gray-water supplies are inadequate for irrigation needs, potable water may be required to supplement the system to keep it full. Be sure to install one-way valves and air-gaps to prevent contaminating drinkable water systems with gray-water due to backflow or siphoning problems. Install an overflow line with a one-way valve to allow excess gray-water to flow into the sewer or black-water septic system.

Tank placement is important for gravity feed, maintenance and aesthetic reasons. Because of warm water temperatures and high humidity levels around a tank, a sealable cover and good air circulation are critical. Elevated humidities in a wood-frame house, for example, can lead to many structural and aesthetic problems. Also, consider personal safety issues to prevent child and pet injury and/or entrapment.

- 3) **Second Septic System** -- Install a gray-water “septic” tank below ground for collection and holding gray-water. Whether you are hooked into a city sewer system or a private leach field for black-water, gray-water can be held in a separate in-ground septic tank or vault. A gray-water septic tank can be designed to use seepage lines that are dug into the root areas of valuable trees. No disinfection is required, only a coarse filter and grease trap. This type of system is designed for below soil surface distribution only.

In-ground septic tanks can provide a low-maintenance means of using gray-water for landscape trees. Like a black-water septic tank and drain field, a gray-water septic tank and seepage lines must meet all local and state health codes. Seek installation advice from sanitation engineers. Gray-water from this gray-water septic tank should never be pumped or sprayed without disinfection onto a landscape.

Filter & Disinfect

If gray-water is to be held, and not used immediately upon generation, several concerns should be understood. Disinfecting and filtering gray-water removes solids, prevents odors, controls turbidity, minimizes foaming, and eliminates most health hazards. Before you can use gray-water in a landscape,

it must be filtered to remove particulate, fiber and floating materials. A grease trap is critical to prevent filter plugging and clogging emitters or soaker hoses.

Gray water held more than two (2) hours must be disinfected because it contains more harmful bacteria than black-water (sewage). Tablet or liquid solutions of chlorine, ultraviolet light or heat can disinfect gray water. Chlorine is most commonly used. A chlorine concentration of 0.5 ppm will disinfect gray-water. As gray-water is held overnight or longer, the chlorine slowly moves out of solution. Any chlorine remaining from laundry wastewater is too dilute to disinfect a gray-water holding tank. To ensure proper disinfection, use a dosing pump to measure chlorine input for every unit of water volume.

Spreading The Wealth

Correctly filtered and disinfected gray-water can be applied through normal irrigation systems. To meet most sanitation regulations, gray-water must be applied somewhere below the soil surface. Avoid sprinkling or forcing gray-water into an aerosol. In some areas, surface applications by soaker hose is acceptable, providing standing puddles and runoff do not occur. Gray-water surface runoff can cause serious erosion and disruption of stream and lake chemistry. Avoid concentrated watering near wells and significant groundwater recharge areas due to potential groundwater pollution. It is important to carefully monitor application and infiltration rates.

Soil Impacts

Gray-water has few long-term effects on soil. Gray-water slightly modifies soil-organism populations and usually initiates no additional pest problems. Changes occurring are usually due to additional water present and lack of adequate drainage. Over-watering and extended periods of soil saturation with gray-water (or regular irrigation water) can cause severe root problems for trees.

Normal residual detergents and soaps are diluted enough for quick degradation in healthy soils. Chlorine bleaching materials, due to their volatility and the warmth of the water, are quickly dissipated or tied-up in soil, especially when applied to medium and fine-textured native soils. However, when applied to coarse sandy soils with little organic matter, tree absorbing-root damage can occur. Organic matter and soil-texture adjustments are critical in raised beds with gray-water irrigation. Do not use gray-water on trees with severely limited root areas or for hydroponics.

Tree Care

Gray-water has few detrimental effects on trees growing in native soils. Acid-loving plants, however, can have problems because detergents make water more alkaline and pH modifications may be occasionally required. Some gray-water and tree health issues to understand and manage are given in Figure 3.

Conserving Water

Under some water restrictions and drought conditions, saving gray-water for tree irrigation is good for trees and landscapes. Using gray-water conserves one of our most precious resources. If managed properly, gray-water creates few detriments and many benefits.

source	percent of water use	
toilet		31%
kitchen	10%	57%
lavatory	22%	
laundry	20%	
miscellaneous	5%	
outdoor watering		12%
total = 100%		

Figure 1: Potable water use of an average household during a growing season. Note 57% of non-waste containing water (gray-water) could potentially be reused for tree irrigation & outdoor watering.

gray-water component	gray-water average (ppm)	gray-water as a percent of total waste water
total solids	530	46%
suspended solids	160	68%
biochemical oxygen demand	200	62%
chemical oxygen demand	365	59%
ammonia (NH ₄)	2	1%
total nitrogen	10	7%
detergents	20	--
total phosphorus (P)	1.5	7%
potassium (K)	10	18%
calcium (Ca)	1	1%
magnesium (Mg)	3	50%
iron (Fe)	15	94%
chlorides (Cl)	45	32%
sodium (Na)	75	43%
grease	100	98%
temperature	122°F	100°F
total coliform bacteria = 7.1 million per ounce (96X black-water) fecal coliform bacteria = 0.4 million per ounce (35X black-water)		

Figure 2: Average characteristics of household gray-water compared with total waste water stream.

Tree Health Care Issues & Gray-Water

- A) Make trees high-priority watering items.**
- B) Use when precipitation is not available.**
- C) Apply to soil surface or below, never onto foliage, twigs or stems.**
- D) Never soak bark or root-collar areas.**
- E) Do not spray edible tree parts, or spray soils where splash can touch edible tree parts.**
- F) Do not use on root or leaf crops.**
- G) Do not use on new tree transplants until well established.**
- H) Do not use on indoor trees with limited rooting space, trees in small containers, or trees normally under saturated conditions (wetlands).**
- I) Avoid using sprinkler heads which form aerosols.**
- J) Be careful of applications to leaves of ground covers.**
- K) Prevent puddles and surface runoff.**
- L) Test soil periodically to reveal salt, pH, and boron problems.**

Figure 3: Select tree health care issues using gray-water.

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