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Laundry to Landscape Graywater System Design Guidelines

General

1. Graywater from clothes washers may be used for landscape irrigation without obtaining a permit, provided the system is designed, installed and operated in compliance with California Plumbing Code Chapter 16A, as summarized in this handout.
2. All other Graywater Systems require a permit. Please refer to the brochure, Building Permit Application Requirements for Residential Graywater Irrigation Systems.

Types of Graywater Systems

1. **Clothes Washer System**- A graywater irrigation system utilizing only a single domestic clothes washing machine, with no tanks, pumps or treatment in a one or two family dwelling. (Described in this brochure).
2. **Simple Graywater Irrigation System** – A system designed to collect less than 250 gallons of graywater per day and transport it out of the structure for distribution in an irrigation field. A simple graywater system requires a Building Permit and may include tanks, valves, filters, pumps or other appurtenances along with piping and receiving landscape. (See Building Permit Application Requirements for Residential Graywater Irrigation Systems).
3. **Complex Graywater Irrigation System** - A system designed to collect more than 250 gallons of graywater per day and transport it out of the structure of distribution in an irrigation field. Requires a Building Permit (See Building Permit Application Requirements for Residential Graywater Irrigation Systems).
4. **Graywater Disposal System** – A wastewater system designed to dispose if graywater throughout the year that is not intended for irrigation. Requires a Sewage Disposal Permit (See Graywater Sump Brochure or On Site Wastewater Treatment Guidelines).

Site Suitability (See the map layers on the County Internet GIS)

Lots having any of the following may be determined inappropriate or require special conditions for graywater irrigation systems:

- High Groundwater levels - Groundwater levels present within three vertical feet from the deepest irrigation or disposal point of the proposed graywater system.
- Slope greater than 30%
- Limited lot size - unable to meet setback requirements to streams, slopes, wells, property lines, septic systems, building structures etc. (CPC Ch16A Table 16A –1).
- **Note: High winter groundwater levels and/or soils with slow permeability will require graywater irrigation to be diverted to building sewer during the wet season to prevent groundwater contamination and/or runoff.**
- **Note: Graywater disposal systems, which are not used for irrigation purposes will need to meet the requirements for Onsite Waste Water Treatment Systems.**

System Requirements

1. The design must allow the user to direct the flow to the irrigation field, or the building sewer or septic system. The direction control of the graywater shall be clearly labeled and readily accessible to the user.
2. The installation, change, alteration or repair of the system may not include a potable water connection or a pump and may not affect other building, plumbing, electrical or mechanical

components including structural features, egress, fire-life safety, sanitation, potable water supply piping or accessibility.
3. The graywater must be contained on site where it is generated.
4. Graywater must be directed to and contained within an irrigation or disposal field.
5. Ponding or runoff is prohibited and shall be considered a nuisance.
6. Graywater may be released on the ground surface provided at least two (2) inches of mulch, rock, or soil or a solid shield covers the release point. Other methods that provide equivalent separation are also acceptable.
7. Graywater systems must be designed and operated to prevent graywater contact with humans and domestic pets.
8. Water used to wash diapers or similarly soiled infectious garments must not be used and must be diverted to the building sewer.
9. Graywater may not contain hazardous chemicals derived from activities such as cleaning car parts, washing greasy or oily rags, or disposing of waste solutions from home photo labs or similar hobbyist or home occupational activities.
10. An operation and maintenance manual must be maintained by the owner for all graywater systems. (Including Clothes Washer Systems). Directions in the manual must indicate the manual is to remain with the building throughout the life of the system and indicate that upon change of ownership or occupancy the new owner or tenant shall be notified the structure contains a graywater system.

System Design Process

These guidelines are for Laundry-Only Graywater Systems. No construction permit is required if requirements in California Plumbing Code (CPC) Chapter 16A are met.

1. **Groundwater Depth**: During the wet season, dig a hole 3 vertical feet below the deepest irrigation point to determine if high ground water levels will limit use of graywater. Presence of groundwater within 3 ft could result in groundwater contamination.
2. **Estimate Daily Graywater Discharge**: Calculate estimates of graywater use based on water use records or by utilizing procedure from CPC Ch 16A 1606A.0 (15 gallons per day (GPD) /occupant) attachment page 4.
3. **Determine area and methods of irrigation/leaching required:** Utilize CPC Table16A-2 attachment page 5.
4. **Determine Location and Set Backs for Graywater System:** Utilize CPC Ch 16A Table 16A-1 (page 5).
5. **Graywater System Materials**: Washing machine-pressurized graywater lines should have an inside diameter of 1” and must be covered by a minimum 2” of mulch, rock, or soil.
6. **System Design Recommendations:** The recommended minimum number of outlets per zone is 6, the maximum is18, depending on the size and type of outlet. Multiple zones are recommended for high use systems or low perk soil (diverting excess laundry water to the sewer is an alternative to diverting it to a different zone, so multiple zones are not required).

Technical Notes

A) Receiving Landscape

Mulch basins are formed by digging a basin deep enough so there is a freefall of water into the basin and so roots wont clog the 1” to ½ inch barbed plastic tee outlet. The number and size of mulch basins the landscape will require will vary based on the number of gallons of graywater expected to discharge daily and the type of soil in the irrigation field. It is critical to have sufficient volume in the mulch basins to receive all the graywater discharged without ponding or running off. Deep mulch basins increase soil percolation, reduce rain runoff, reduce water use, increase soil fertility and ease stress on water treatment plants and septic tanks. Mulch is organic waste material including leaves, prunings, straw, pulled weeds and woodchips. It is recommended to put woody mulch near the bottom of the mulch basin because it is more durable and permeable.

B) Distribution Plumbing

To get the pressurized graywater to plants, 1” polyethylene tubing is the preferred distribution plumbing. Polyethylene tubing is the same material commonly used for drip irrigation, just in a bigger size. Smaller tubing gives too much resistance. Bigger tubing traps more septic water and solids. Use the kind with a purple stripe to indicate non—potable water. All Graywater distribution piping shall be identified with the words “CAUTION: NONPOTABLE WATER, DO NOT DRINK.” You can run a single or multi-trunk line, with or without valves or branches. Branches can be 1” or ¾” or ½” drip tubing. It is recommended that if you have a large volume of graywater and/or low-perk soil, use two or more valved zones. Be sure to note the location of hidden plumbing on a drawing or photographs for the operators manual. It is best that the line slopes downhill continuously to prevent freezing, smells and to ease stress on the pump. Another option is a U-shaped line with an outlet at the low point to drain the U, though this may trap water in the line between uses. This is acceptable, unless freezing temperatures cause the line to freeze. Graywater can go septic if it sits for more than 24 hours. However, the quantity in even a long run of 1” pipe is so small that any objectionable smell is only detectable for the first moment of discharge. In an installation that includes both some rise and a long horizontal run, the quantity of trapped water is minimized by sending the pipe up to the maximum height as quickly as possible, then running the pipe down from there. This way, most of the run drains dry after each use. This same geometry works to get the water up from a basement washer to the yard.

C) Outlets

1” to ½ inch plastic barbed tee fittings are recommended for the outlets. Other types of outlets could include ½ in barbed valves, 3/8” barbed outlets, ¼-3/8” drilled holes. To prevent clogging use a mulch shield around the outlet. Cut out the sides out of a 1+ gallon bucket so there is a place for the tubing to run through the center. Cut out the bottom so it opens like a hinged lid, this will provide a solid shield covering the outlet release point and easy access for maintenance. Place the bucket upside down, buried in the mulch basin with the polyethylene tubing running through the cut out sides of the bucket and the barbed tee outlet centered inside, preventing the mulch from touching the outlet. The capacity of all the outlets should be enough that the pump is not strained trying to push too much water through too small or too few holes. Also too large or too many holes will result in pressure loss that may leave some outlets dry.

D) Diversion

All graywater systems shall be designed to allow the user to direct the flow to either the irrigation field or building sewer. The means of changing the direction of the graywater shall be clearly labeled and readily accessible to the user (CPC Ch.1601A.0 E). A three-way valve is mounted on the wall behind the washer, or where it is easily visible and convenient to turn. It should be solidly secured to the wall using copper pipe brackets so it does not move when the handle is torqued (1” brass valve is ideal. One side of the valve diverts water into the sewer standpipe through a vacuum break, to the graywater system. The graywater destinations should be clearly labeled, e.g. “Sewer” and “Orchard”. NOTE: If you are doing a load with bleach or fabric softener, send the water to the sewer.

E) Vacuum Breaker

If the first outlet is lower than the level of water in the washer, a vacuum breaker is necessary to keep the drain from continuously siphoning water out of the machine as it tries to refill itself. The lose fit of the washing machine drain hose into the standpipe in conventional plumbing creates a vacuum breaker. The vacuum breaker must connect to the main drain line at its high point to be effective. This is typically close to the washer, just outside the house. The drain line shall be hard piped from the washer drain line connection to the irrigation system connection at the exterior of the house. In addition to the air breaker at the highest point of this connection, back flow prevention shall be installed at the connection to the irrigation distribution system.

F) Backflow Prevention

Backflow prevention on the potable water supply line to the house (i.e., air gap separation, reduced pressure principle assemble, or double check value) is required if the system meets the definition of being an “auxiliary water supply”. Systems without a storage tank or pump may not meet this definition, but backflow prevention is always a good idea.

G) Hose Connection

A temporary hose connection makes tuning the outlets easier (you won't have to keep doing load after load of laundry to check and tune the outlet flows). It is also good for blowing out lint if needed (be careful to not over-pressurize the system, as the irrigation tubing connections cannot handle more than about 20psi). Check valves and hose connections may not be required for every system design. However, if you include these components, the chance of having trouble with your system is much smaller and the performance and maintenance of the system will be improved. The hose service connection must be properly installed with back flow prevention so there is no chance of graywater back flowing into the freshwater lines. The layers of protection against this are: 1) only connect the hose with washer disconnected; 2) install a swing check valve; 3) install a backflow prevention device at the hose bib. To tune the outlets perfectly, check the flow from the washer by timing how long it takes it to fill a bucket. Then adjust the hose to the same flow. **Do not leave the hose connected unless testing or cleaning the lines.**

H) Washer Pump Performance and Distribution Plumbing Limitations

Laundry to mulch basin systems use the washing machine pump to distribute the water. Without stressing the pump you can irrigate any distance downhill, or pump up to an elevation 2' below the top of the washer 100' away (100' of horizontal 1" tubing offers the same resistance as 20" of vertical rise). The resistance the pump has to overcome should ideally be about the same as in a standard installation, where the hose discharges at the height of the top of the machine. For example, if a washing machine empties through 100' of 1" pipe that ends 18" lower than its lid; the effective resistance is the same as if it discharged 2" above its lid. To avoid backflow, don't irrigate at a height above the washer.

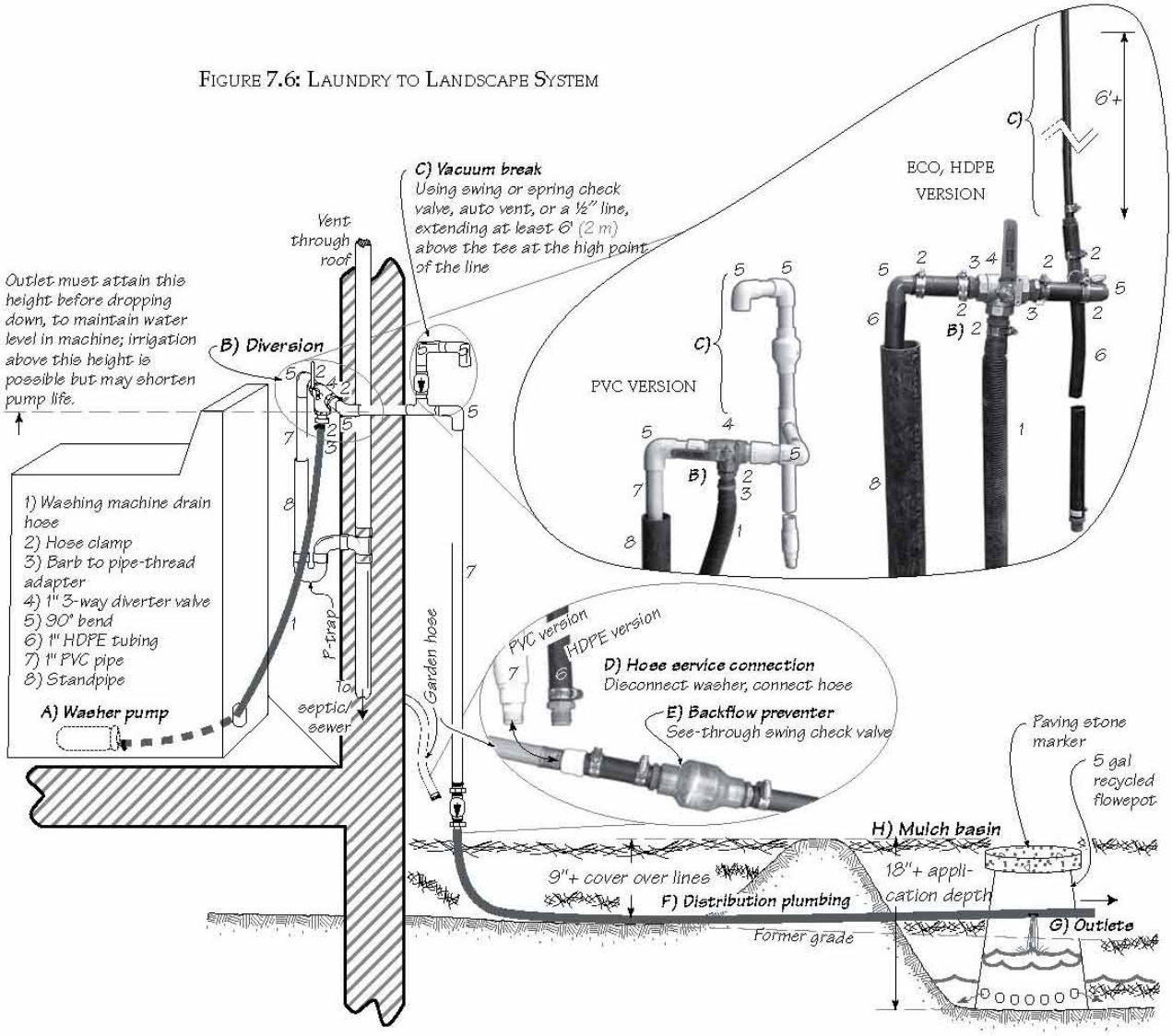
I) Soaps and Detergents

Avoid soaps that contain boron, Clorox, salt or sodium (eg. sodium lauryl sulfate) as they can be harmful to your plants.

For more information:

- **California Plumbing Code Chapter 16A Non-potable Water Reuse Systems:** http://www.hcd.ca.gov/codes/shl/Preface_ET_Emergency_Graywater.pdf
- **City of Santa Barbara:** http://www.santabarbaraca.gov/Resident/Water/Water_Conservation/WCSustainableOptions.htm
- **Oasis Designs:** http://oasisdesign.net/ (Diagrams, pictures, parts and video on installation process).

FIGURE 7.6: LAUNDRY TO LANDSCAPE SYSTEM



Procedure for Estimating Graywater Discharge

(A) Single Family Dwellings and Multi-Family Dwellings. The graywater discharge for single family and multi-family dwellings shall be calculated by estimates of graywater use based on water use records, calculations of locally daily per person interior use, or the following procedure:

1. The number of occupants of each dwelling unit shall be calculated as follows:

First bedroom	2 occupants
Each additional bedroom	1 occupant

2. The estimated graywater flows of each occupant shall be calculated as follows:

Laundry	15 GPD /occupant

3. The total number of occupants shall be multiplied by the applicable estimated graywater discharge as provided above.

Table for Determining Area of Irrigation/Leaching Required:

Table 16A-2 Design Criteria of Six Typical Soils		
Type of Soil	**Square Feet**	**Gallons**
	Minimum square feet of irrigation/leaching area per 100 gallons of estimated graywater discharge per day	Maximum absorption capacity in gallons per square foot of irrigation/leaching area for a 24 hour period
Coarse sand or gravel	20	5
Fine sand	25	4
Sandy loam	40	2.5
Sandy clay	60	1.7
Clay with considerable sand or gravel	90	1.1
Clay with small amounts of sand or gravel	120	0.8

Table for Determining Location and Set Backs for Graywater System:

Table 16A-1 Location of Graywater System

Minimum Horizontal Distance Required From:	**Tank**	**Irrigation Field**	**Disposal Field**
	Feet	**Feet**	**Feet**
Building structures (1)	5 (2)	2	5
Property line adjoining private property	5	1.5 ft	5
Water supply wells (3)	50	100	100
Streams and lakes (3)	50	100 (4,5)	100 (4)
Sewage pits or cesspools	5	5	5
Sewage disposal field	5	4 (6)	4 (6)
Septic tank	0	5	5
Onsite domestic water service line	5	0	0)
Pressurized pubic water main	10	10 (7)	10 (7)

(1) Building structures does not include porches and steps, whether covered or uncovered, breezeways, roofed porte cocheres, roofed patios, carports, covered walks, covered driveways and similar structures or appurtenances.

(2) Underground tanks shall not be located within a 45-degree angle from the bottom of the foundation, or they shall be designed to address the surcharge imposed by the structure. The distance may be reduced to six (6) inches for aboveground tanks when first approved by the Enforcing Agency.

(3) Where special hazards are involved, the distance required shall be increased as directed by the Enforcing Agency.

(4) These minimum clear horizontal distances shall also apply between the irrigation or disposal field and the ocean mean higher high tide line.

(5) The minimum horizontal distance may be reduced to 50 feet for irrigation fields utilizing graywater which has been filtered prior to entering the distribution piping.

(6) Plus two (2) feet for each additional foot of depth in excess of one (1) foot below the bottom of the drain line.