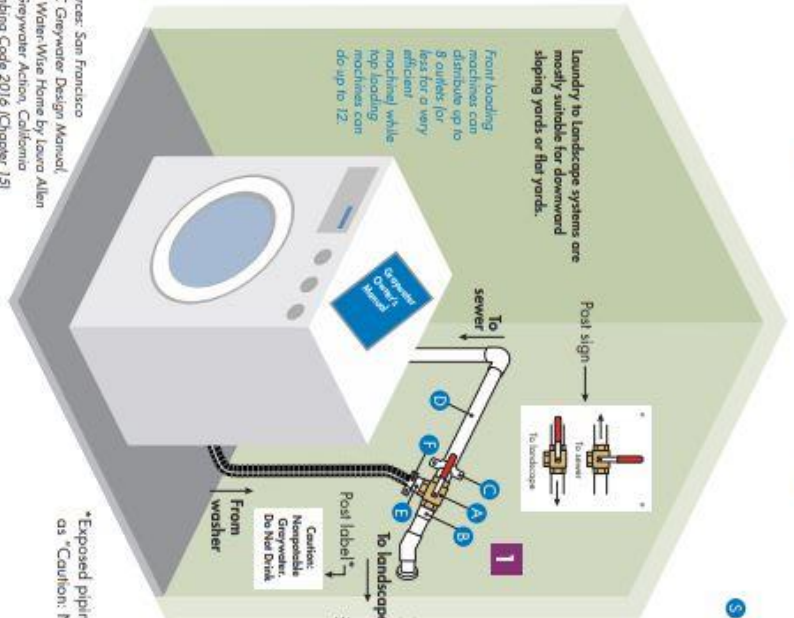
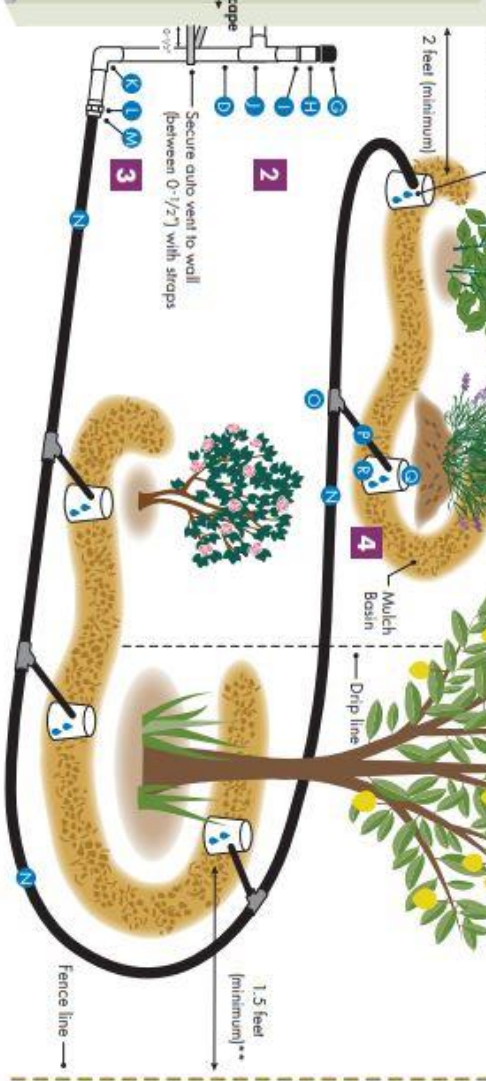


Graywater Master Handout

Laundry to Landscape: Graywater System Example



5 To allow the free-flow of water, the end of the main-line tubing remains fully open with no plug or valve.

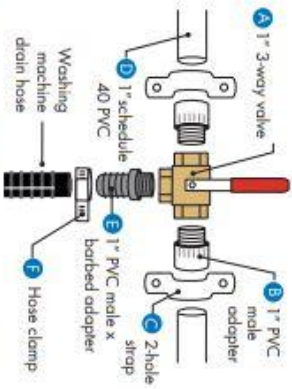


*Exposed piping needs to be labeled every 5 feet as "Caution, Nonpotable Graywater, Do Not Drink."

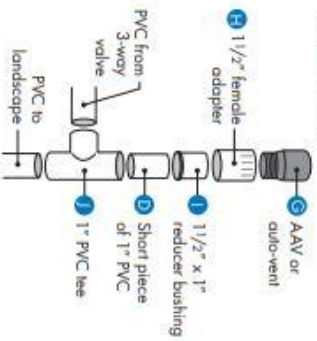
**Increase distance if adjacent property has horseshoe or is lower in elevation.

Fruits and vegetable plants are safe to irrigate with graywater so long as the edible portion doesn't touch the ground and/or mulch.

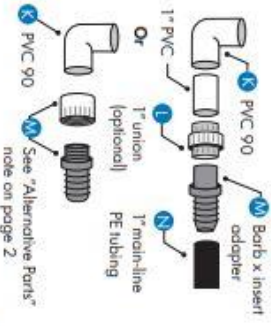
1 Diverter (3-way) Valve



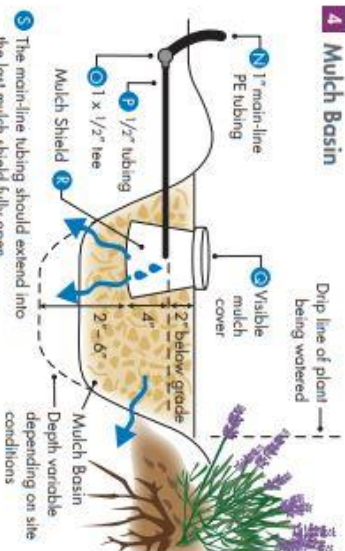
2 Auto Vent



3 Transition to the Landscape Side of the System



4 Mulch Basin



This diagram is not drawn to scale and is provided for reference purposes only. It is your responsibility to properly design, install, maintain, and use your laundry to landscape graywater system. If you are unsure of the intricacies of your plumbing system or how to properly design or install a graywater system, please consult with a professional. Valley Water does not accept any liability and responsibility for any direct, special, indirect or consequential loss or damage whatsoever arising out of or in connection with providing you with access to this diagram.

Source: San Francisco PUC Graywater Design Manual, The Water-Wise Home by Laura Allen of Graywater Action, California Plumbing Code 2016 (Chapter 15)

Graywater Codes & Regulations

Graywater is simple but building codes can be confusing. The following excerpts are meant to clarify the permitting process. Please read carefully and check with the local Enforcing Agency or a Graywater installer if you have questions.

Laundry-to-Landscape Code

Extracted from the 2016 California Plumbing Code (Chapter 15A, Part 2)

A graywater system, utilizing only a single domestic clothes washing machine in a one or two family dwelling, in compliance with all of the following, may be installed or altered without a construction permit:

1. If required, notification has been provided to the Enforcing Agency regarding the proposed location and installation of a graywater irrigation or disposal system.
2. The design shall allow the user to direct the flow to irrigation or disposal field or the building sewer. The direction control of the graywater shall be clearly labeled and readily accessible to the user.
3. The installation, change, alteration or repair of the system does not include a potable water connection or a pump and does not affect other building, plumbing, electrical or mechanical components including structural features, egress, fire-life safety, sanitation, potable water supply piping or accessibility.
4. The graywater shall be contained on the site where it is generated.
5. Graywater shall be directed to and contained within an irrigation or disposal field.
6. Ponding or runoff is prohibited and shall be considered a nuisance.
7. Graywater may be released above the ground surface provided at least two (2) inches of mulch, rock, or soil, or a solid shield covers the release point. Other methods which provide equivalent separation are also acceptable.
8. Graywater systems shall be designed to minimize contact with humans and domestic pets.
9. Water used to wash diapers or similarly soiled or infectious garments shall not be used and shall be diverted to the building sewer.
10. Graywater shall 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.
11. Exemption from construction permit requirements of this code shall not be deemed to grant authorization for any graywater system to be installed in a manner that violates other provisions of this code or any other laws or ordinances of the Enforcing Agency.
12. An operation and maintenance manual shall be provided. Directions shall 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.

Showers-to-Flowers (aka. Branched Drain) Code

1502.1.2 Simple System. Simple systems exceed a clothes washer system and shall comply with the following:

1. The discharge capacity of a graywater system shall be determined by Section 1502.8 Simple systems have a discharge capacity of 250 gallons (947 L) per day or less.
2. Simple systems shall require a construction permit, unless exempted from a construction permit by the Enforcing Agency. The Enforcing Agency shall consult with any public water system (as defined in Health and Safety Code, Section 116275) providing drinking water to the dwelling before allowing and exemption from a construction permit.
3. The design of simple systems shall be acceptable to the Enforcing Agency and shall meet generally accepted graywater system design criteria.

1502.1.3 Complex System. Any graywater system that is not a clothes washer system or simple system shall comply with the following:

1. The discharge capacity of a graywater system shall be determined by Section 1502.8. Complex systems have a discharge capacity over 250 gallons (947 L) per day.
2. Complex systems shall require a construction permit, unless exempted from a construction permit by the Enforcing Agency. The Enforcing Agency shall consult with any public water system (as defined in Health and Safety Code, Section 116275) providing drinking water to the dwelling before allowing and exemption from a construction permit.
3. A complex system shall be designed by a person who can demonstrate competence to the satisfaction of Enforcing Agency.

Setbacks

Landscape Feature Minimum Distance

Landscape Feature Considerations	Minimum Horizontal Distance from Graywater Irrigation System
Building structures	2 ft
Property line adjoining private property *	1.5 ft
Water supply wells	100 ft
Streams, Rivers, Lakes, Wetlands, and High Tide line of Ocean	100 ft
Sewage pits or cesspools	5 ft
Sewage disposal field	4 ft
Septic tank	5 ft
Onsite domestic water service line	0 ft
Pressurized public water main	10 ft

Laundry-to-Landscape: Estimating Graywater Production

*Assuming laundry is done throughout the week

Step 1: Determine the output of Graywater fixtures

Weekly # of laundry loads = _____

gallons per load = _____

Consult laundry machine user manual for actual figure; average front loader is 15 gal, vs. top loader at 40 gal

Gallons of laundry Graywater produced per wk.
 (# of loads per week) x (gallons per load) = _____

Step 2: Determine irrigation field size or minimum surge capacity

Irrigation field size sq. ft. = (gallons per day) / (daily soil absorption rate)

of gallons per week / 7 days = gallons per day = _____

daily soil absorption rate = _____

*Gallons per square foot of 24 hour leaching Table 16A-2
 Gallon column (Back of Page)*

Irrigation field size sq. ft.
 (gallons per day) / (daily soil absorption rate) = _____

Step 3: Estimate plant water budget

Weekly water budget

$(.62 \times \text{Area} \times \text{Eto} \times \text{Pf}) / 4 \text{ weeks} =$ _____

$.62 = (.62 \text{ gallon in } 1'' \text{ of water covering } 1 \text{ ft}^2)$

Area = $\pi r^2 = (3.14 \times \text{canopy radius}) * \text{number of plants}$ OR
 = $(\text{Length} * \text{Width}) * \text{number of garden beds}$

Eto (July) = **7.44"/month** * *Highest ETo rate of Cloverdale, Healdsburg, Windsor, Santa Rosa.*
 = **6.51"/month** * *Highest ETo rate of Petaluma.*

Pf = Plant factor = 0.1 - 0.3 (Low water use) ex: Lavender, sage

0.4 - 0.6 (Medium water use) ex: Fig, Roses

0.7 - 0.9 (High water use) ex: Australian tree fern

** check WUCOLS for more info (back of page)*

Step 4: Cross check and adjust

* If water budget is more than 20% > Graywater output, plants may experience drought stress.

Laundry-to-Landscape: Estimating Graywater Production

***Assuming all laundry is done in one day**

Step 1: Determine the output of Graywater fixtures

Weekly # of laundry loads = _____

gallons per load = _____

Consult laundry machine user manual for actual figure; average front loader is 15 gal, vs. top loader at 40 gal

Gallons of laundry Graywater produced per day
 (# of loads per day) x (gallons per load) = _____

Step 2: Determine irrigation field size or minimum surge capacity

Irrigation field size sq. ft. = (gallons per day) / (daily soil absorption rate)

Gallons per day = _____

daily soil absorption rate = _____

*Gallons per square foot of 24 hour leaching Table 16A-2
 Gallon column (Back of Page)*

Irrigation field size sq. ft.
 (gallons per day) / (daily soil absorption rate) = _____

Step 3: Estimate plant water budget

Weekly water budget

(.62 x Area x Eto x Pf) / 4 weeks = _____

.62 = (.62 gallon in 1" of water covering 1 ft²)

Area = πr^2 = (3.14 x canopy radius) * number of plants OR
 = (Length * Width) * number of garden beds

Eto (July) = 7.44"/month * Highest ETo rate of Cloverdale, Healdsburg, Windsor, Santa Rosa.

= 6.51"/month * Highest ETo rate of Petaluma.

Pf = Plant factor = 0.1 - 0.3 (Low water use) ex: Lavender, sage

0.4 - 0.6 (Medium water use) ex: Fig, Roses

0.7 - 0.9 (High water use) ex: Australian tree fern

** check WUCOLS for more info (back of page)*

Step 4: Cross check and adjust

* If water budget is more than 20% > Graywater output, plants may experience drought stress.

Soil Absorption, Plant Factors, and Evapotranspiration

Soil Absorption Rates

Table 16A-2 Design Criteria of Six Typical Soils

Type of Soil	Square Feet	Gallons	Square Meters	Liters
	<i>Minimum square feet of irrigation/leaching area per 100 gallons of estimated graywater discharge per day</i>	<i>Maximum absorption capacity in gallons per square foot of irrigation/leaching area for a 24-hour period</i>	<i>Minimum square meters of irrigation/leaching area per liter of estimated graywater discharge per day</i>	<i>Maximum absorption capacity in liters per square meter of irrigation/leaching area for a 24-hour period</i>
Coarse sand or gravel	20	5.0	0.005	203.7
Fine sand	25	4.0	0.006	162.9
Sandy loam	40	2.5	0.010	101.8
Sandy clay	60	1.7	0.015	69.2
Clay with considerable sand or gravel	90	1.1	0.022	44.8
Clay with small amounts of sand or gravel	120	0.8	0.030	32.6

Evapotranspiration Rates by Zone



Monthly Average Reference Evapotranspiration by ETo Zone (inches/month)

Sample Zone	32 %	38 %	58 %	76 %	89 %	96 %	100%	95 %	76 %	58 %	41 %	32 %	Total
Zone 1	0.93	1.40	2.48	3.30	4.03	4.50	4.65	4.03	3.30	2.48	1.20	0.62	33.0
Zone 2	1.24	1.68	3.10	3.90	4.65	5.10	4.96	4.65	3.90	2.79	1.80	1.24	39.0
Zone 3	1.86	2.24	3.72	4.80	5.27	5.70	5.58	5.27	4.20	3.41	2.40	1.86	46.3
Zone 4	1.86	2.24	3.41	4.50	5.27	5.70	5.89	5.58	4.50	3.41	2.40	1.86	46.6
Zone 5	0.93	1.68	2.79	4.20	5.58	6.30	6.51	5.89	4.50	3.10	1.50	0.93	43.9
Zone 6	1.86	2.24	3.41	4.80	5.58	6.30	6.51	6.20	4.80	3.72	2.40	1.86	49.7
Zone 7	0.62	1.40	2.48	3.90	5.27	6.30	7.44	6.51	4.80	2.79	1.20	0.62	43.4
Zone 8	1.24	1.68	3.41	4.80	6.20	6.90	7.44	6.51	5.10	3.41	1.80	0.93	49.4
Zone 9	2.17	2.80	4.03	5.10	5.89	6.60	7.44	6.82	5.70	4.03	2.70	1.86	55.1
Zone 10	0.93	1.68	3.10	4.50	5.89	7.20	8.06	7.13	5.10	3.10	1.50	0.93	49.1
Zone 11	1.55	2.24	3.10	4.50	5.89	7.20	8.06	7.44	5.70	3.72	2.10	1.55	53.0
Zone 12	1.24	1.96	3.41	5.10	6.82	7.80	8.06	7.13	5.40	3.72	1.80	0.93	53.3
Zone 13	1.24	1.96	3.10	4.80	6.51	7.80	8.99	7.75	5.70	3.72	1.80	0.93	54.3
Zone 14	1.55	2.24	3.72	5.10	6.82	7.80	8.68	7.75	5.70	4.03	2.10	1.55	57.0
Zone 15	1.24	2.24	3.72	5.70	7.44	8.10	8.68	7.75	5.70	4.03	2.10	1.24	57.9
Zone 16	1.55	2.52	4.03	5.70	7.75	8.70	9.30	8.37	6.30	4.34	2.40	1.55	62.5
Zone 17	1.86	2.80	4.65	6.00	8.06	9.00	9.92	8.68	6.50	4.34	2.70	1.86	66.5
Zone 18	2.48	3.36	5.27	6.90	8.68	9.60	9.61	8.68	6.90	4.96	3.00	2.17	71.6

Variability between stations within single zones is as high as 0.02 inches per day for zone 1 and during winter months in zone 13. The average standard deviation of the ETo between estimation sites within a zone for all months is about 0.01 inches per day for all 200 sites.

Plant Factors Use WUCOLS - <http://ucanr.edu/sites/WUCOLS/>

Soaps for Graywater

Laundry-to-Landscape - Detergents

The following list of laundry detergents are safe for using with your Laundry-to-Landscape Graywater system:

- ✓ Oasis laundry Liquid
- ✓ Ecos Liquid Detergent
- ✓ Bio Pac Laundry Liquid
- ✓ Biokleen Laundry Liquid
- ✓ LifeTree Laundry Liquid
- ✓ Ecover Laundry Wash (some salt)
- ✓ Mountain Green Laundry Detergent
- ✓ Vaska Herbatergent

Showers-to-Flowers - Soaps & Shampoos

- ✓ Oasis Dishwash - all-purpose cleaner for hand-washing dishes, body & shampoo
- ✓ Dr. Bronner's Magic Soaps (liquid)
- ✓ Aubrey Organics Shampoos
- ✓ More coming out all the time...read the ingredients!

Avoid Detergents and Soaps Which Contain:

- ✗ boron/borax (toxic to plants)
- ✗ sodium and ingredients with the word "sodium" in them*
- ✗ chlorine bleach (acceptable alternative: hydrogen peroxide)
- ✗ sodium perborate
- ✗ sodium hypochlorite
- ✗ peroxygen
- ✗ petroleum distillate
- ✗ alkylbenzene
- ✗ water softeners (contain sodium chloride or potassium chloride)
- ✗ anti-bacterial soaps & cleaners
- ✗ "whiteners", "softeners"
- ✗ enzymes (enzymes in biological washing powders break down protein or fat stains on clothes)
- ✗ titanium oxide
- ✗ chromium oxide
- ✗ artificial colors; FD&C colors
- ✗ synthetic fragrance
- ✗ artificial preservatives

Graywater Laundry-2-Landscape Parts List

Part Name	Needed
1" Brass 3-way diverter valve	
1 1/2" Air vent	
1" PVC Coupling (slip X slip)	
1" PVC 90 degree elbow (slip X slip)	
1" PVC 45 degree elbow (slip X slip)	
1" PVC male adapter (slip X male pipe thread)	
1" PVC Tee (slip X slip X slip) – for air vent	
1 1/2" X 1" Bushing (slip X slip) – for air vent	
1 1/2" X 1" Female adapter (slip X threaded) – for air vent	
3/4" – 1 1/2" Stainless hose clamp – for washer hose	
1 1/4" Metal bracket (2 hole strap) – for mounting valve	
3/4" Male X 1" female swivel – for flushing system	
1" Threaded union (thread X thread) – transition from PVC to HDPE	
1" X 1" X 1/2" Insert reducer tee (barbed X barbed X barbed)	
1" 90 degree insert elbow (barbed X barbed)	
1" X 1" X 1" Insert tee (barbed X barbed X barbed)	
1" Insert coupling (barbed X barbed)	
1" Insert male adapter (threaded X barbed)	
1" Irridelco adapter (adapts HDPE to female garden hose fitting)	
1/2" Greenback ball valve – for inside mulch shields	
6" valve box with lid (mulch shield)	
1" High Density Polyethylene (HDPE) pipe	
1/2" High Density Polyethylene (HDPE) pipe	
1" Schedule 40 PVC pipe	

Additional items needed:

- Teflon tape
- PVC glue & Primer (Gorilla PVC glue recommended—does not require primer)
- U-stakes (to hold HDPE pipe in place)
- Mulch (large chunks recommended)
- Corded or cordless drill
- long pilot bit to drill through wall
- 1.5" hole saw
- Phillips head screwdriver or drill bit
- 1/8" drill bit (to pre-drill screw holes)
- Extension cord
- Pickaxe and shovel
- PVC cutters or hacksaw
- Bubble level (optional)
- Channel locks, vice grips or crescent wrench
- Tape measure

Laundry-to-Landscape Graywater System Owner's Manual

The purpose of the manual is to explain the features of the graywater system located at _____ and to provide the user with proper care and trouble-shooting instructions. These instructions are to remain with the building throughout the life of the system, and upon change of ownership/occupancy, the new owner/occupant shall be notified the building contains a graywater system.

Turning the Graywater System Off

Locate the 3-way valve and turn the handle to direct the wastewater to the sewer system. If using the system for the first time, you should check to make sure the system is shut off and that the 3-way valve is labeled correctly.

When the Graywater System Should Be Shut Off

- During very rainy periods (typically November through April)
- When washing dirty diapers
- If water isn't draining well and you see pooling or runoff
- If you think your plants are receiving too much water
- Anytime household products that are harmful to plants (i.e. bleach, harsh cleaners) are used

Note: Harmful chemicals (i.e. gasoline, oil, etc.) should be disposed of through Hazardous Waste.

Products That Should Be Avoided

- Salt (sodium)
- Boron (borax)
- Chlorine bleach

When using products that could be harmful to plants, wastewater should be diverted to the sewer system by turning the 3-way valve.

Maintaining the Graywater System

Like any irrigation system, seasonal maintenance should be performed. In between maintenance check-ups, keeping an eye on the overall performance of the system is very important. Pooling or runoff should not occur. Maintenance or trouble-shooting steps include:

Mulch/Distribution Basin – Check the mulch/distribution basins regularly. It is important that they remain sized appropriately to prevent pooling or runoff during the graywater surge of a clothes washing machine, bathtub or shower. Mulch should be replenished as needed due to decomposition of organic matter. Basins will require periodic maintenance, reshaping or removal of dirt to maintain surge capacity and to accommodate plant growth. If you notice any pooling or runoff, you should dig out the mulch area, size appropriately and fill with new mulch (wood chips or bark).

Check for clogs – Make sure water is coming out evenly from all distribution points. If uneven distribution is observed, you should open any partially closed ball valves, attach garden hose to the clean-out point and flush system with water to eliminate any stuck particles. Note: Anytime you attach a garden hose to the system make sure you have an anti-siphon valve or vacuum breaker on your garden hose bib and that the distribution system is disconnected from the graywater system.