

Introduction to Graywater Systems

City of Ashland

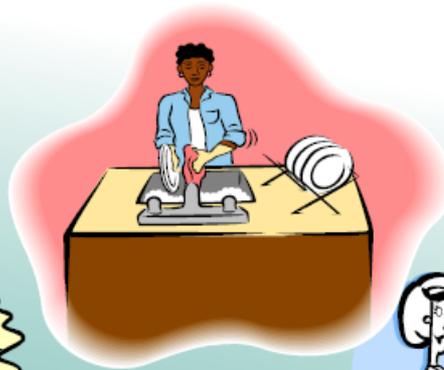
Julie Smitherman, Water Conservation Specialist

April 6, 2015

What is Graywater?

- Graywater means shower and bath wastewater, bathroom sink wastewater, kitchen sink wastewater, and laundry wastewater.
- Graywater does not mean toilet or garbage wastes or wastewater contaminated by soiled diapers.

[ORS 454.605]



Why Use Graywater



Save treatment costs at WWTP



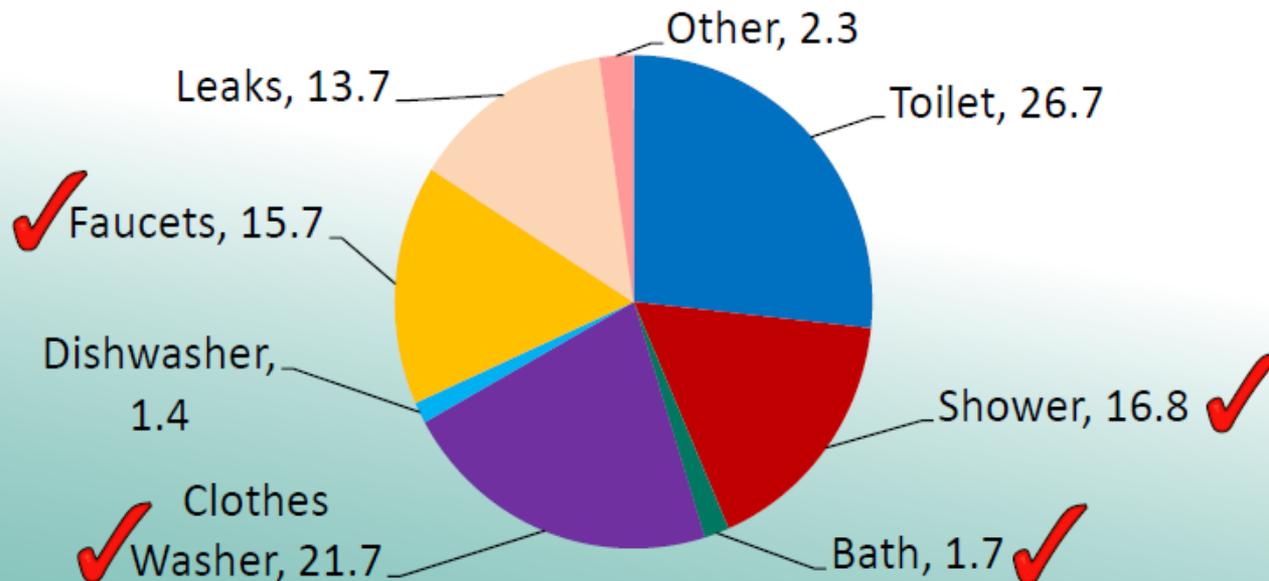
Reduce thermal discharges to Bear Creek



Save money by reducing use of potable water for non-potable uses, such as irrigation

How Much Graywater is Produced?

- 60% of household wastewater originates from graywater sources
- An average household produces approximately 90-110 gallons of graywater per day



Average indoor water use for 12 North American cities for fixture or appliance. Data expressed at percent total flow, which averaged 69.3 gallons per capita per day. (Data adapted from the 1999 American Water Works Association Research Foundation's Residential End Use of Water Study.)

How Much Graywater Do I Produce

Consider the sources of graywater you can “harvest”



Showers & baths

- Relatively clean
- Predictable volume and frequency



Bathroom sinks

- High conc. of personal care products
- Low volume



Laundries

- Predictable volume and frequency
- High conc. of lint/fiber
- Detergents can be hard on plants



Kitchen sinks

- “Dirtiest” source
- May contain high conc. of organics, solids, fats, oils, grease, bacteria
- Required physical treatment

INDOOR WATER USE GUIDE

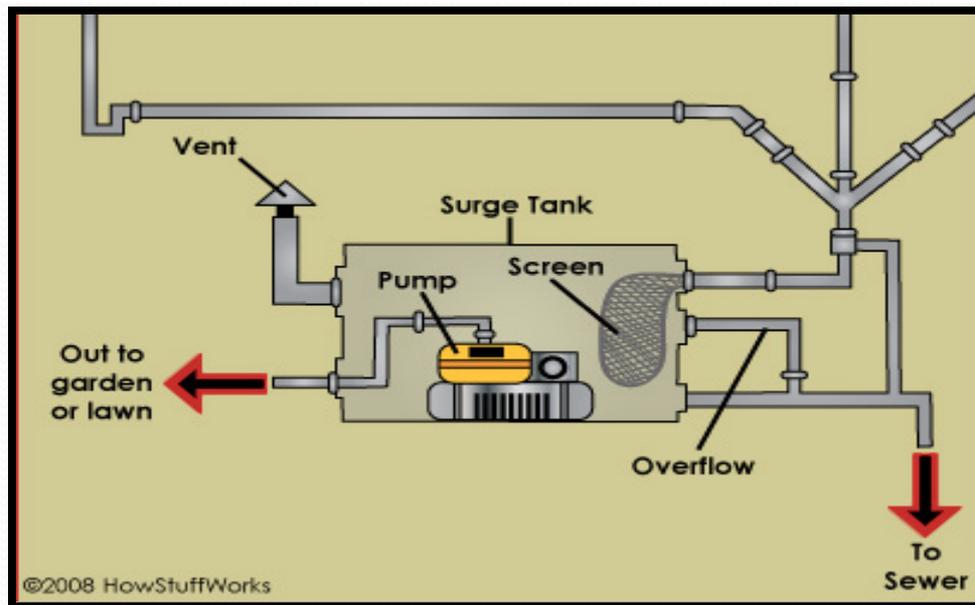


FIXTURE	TYPE	WATER USE RATE		FAMILY SIZE		
				1	2	4
TOILETS		Gallons / Flush	* Uses / Day	Daily Water Use (Gallons) 1 gal = 0.133 cu.ft.		
	Older than 1950	6.0	5.0	30.0	60.0	120.0
	1950 - 1980	5.0	5.0	25.0	50.0	100.0
	1980 - 1994	3.5	5.0	17.5	35.0	70.0
	1994 or newer	1.6	5.0	8.0	16.0	32.0
	WaterSense	1.3	5.0	6.5	13.0	26.0
	Dual Flush	1.0	5.0	5.0	10.0	20.0
SHOWERS		Gallons / Minute	* Minutes / Shower	Daily Water Use (Gallons) 1 gal = 0.133 cu.ft.		
	Older than 1980	5.0 - 7.0	10.0	50.0 - 70.0	100.0 - 140.0	200.0 - 280.0
	1980 - 1994	3.5	10.0	35.0	70.0	140.0
	1994 or newer	2.5	10.0	25.0	50.0	100.0
	WaterSense	2.0	10.0	20.0	40.0	80.0
	WaterSense	1.5	10.0	15.0	30.0	60.0
KITCHEN & BATHROOM FAUCETS		Gallons / Minute	* Minutes / Day	Daily Water Use (Gallons) 1 gal = 0.133 cu.ft.		
	No aerator	7.0	8.0	56.0	112.0	224.0
	Older than 1980	5.0	8.0	40.0	80.0	160.0
	1980 - 1994	3.0	8.0	24.0	48.0	96.0
	1994 or newer	2.5	8.0	20.0	40.0	80.0
	Standard	2.2	8.0	17.6	35.2	70.4
	WaterSense	1.5	8.0	12.0	24.0	48.0
	WaterSense	1.0	8.0	8.0	16.0	32.0
BATHTUB (22" x 54")	Water Depth	Gallons / Use	* Uses/Person/Day	Daily Water Use (Gallons) 1 gal = 0.133 cu.ft.		
	4 inches	21.0	1.0	21.0	42.0	84.0
	8 inches	41.0	1.0	41.0	82.0	164.0
CLOTHES WASHERS		Gallons / Full Load	* Loads/Person/Week	Daily Water Use (Gallons) 1 gal = 0.133 cu.ft.		
	Older than 1980	55.0	2.0	15.7	31.4	62.8
	Top Load	40.0	2.0	11.4	22.8	45.6
	Front Load	25.0	2.0	7.1	14.2	28.4
	Energy Star	14 OR LESS	2.0	4.0	8.0	16.0

* Actual usage may vary. Table by Julie Smitherman Sources: American Water Works Association (AWWA), Residential End Uses of Water, 1999. Amy Vickers, Handbook of Water Use and Conservation, 2001. Environmental Protection Agency (EPA), Water and Energy Savings from High Efficiency Fixtures and Appliances in Single Family Homes, 2005. EPA, WaterSense & Energy Star

What is a Graywater System

- Any existing or proposed graywater collection and distribution system equipped with a diversion device that can direct graywater between beneficial reuse and disposal.



Graywater System Tiers

Oregon recognizes three types of graywater:

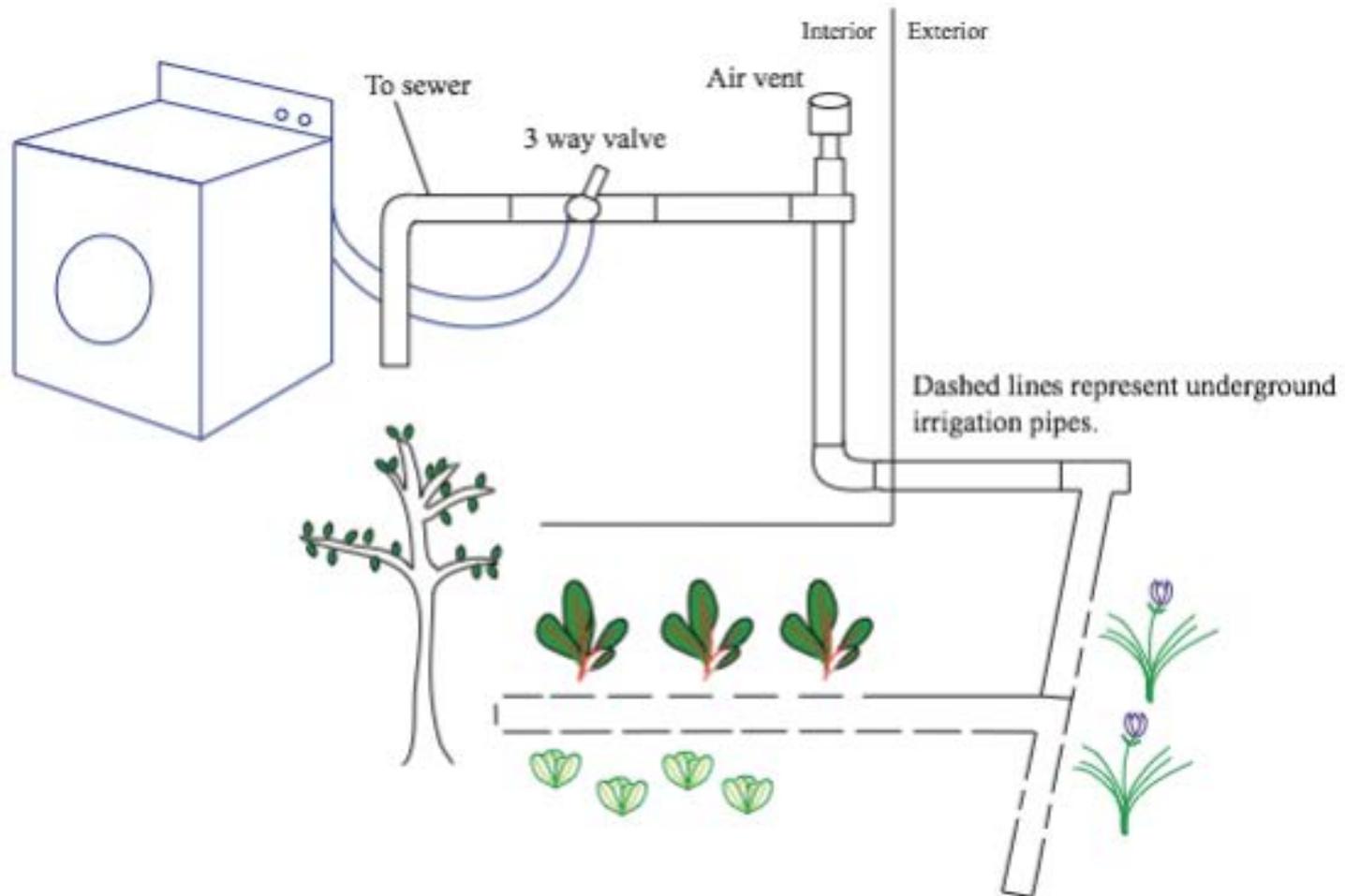
- **Type 1:** Untreated or has passed through a physical process to remove solids, fats, oils and grease (filter).
- **Type 2:** Has passed through some type of chemical or biological process, such as a wetland, to further reduce solids and organic matter.
- **Type 3:** Type 2 graywater that is also disinfected.

Types of Graywater Systems

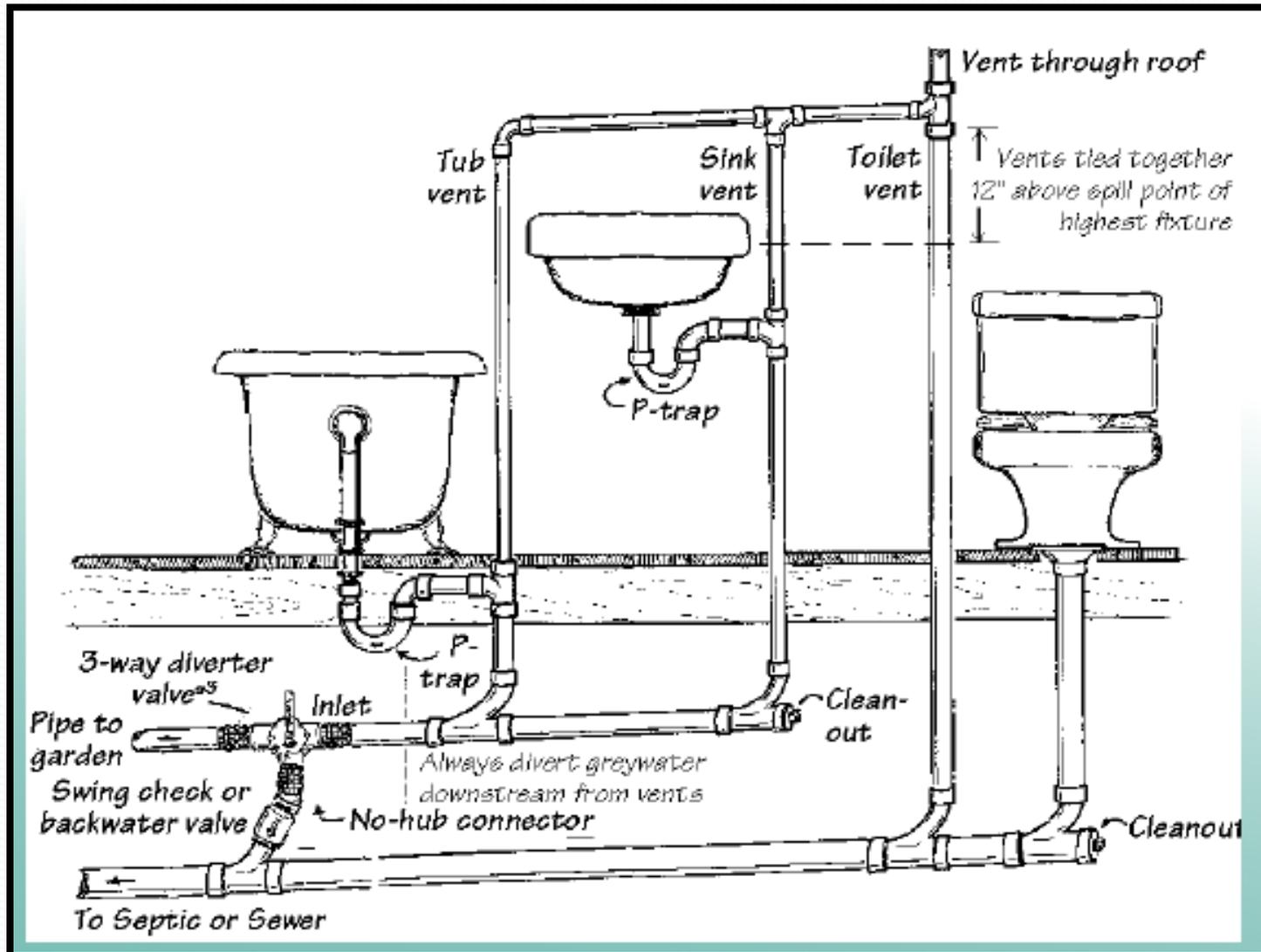
	Application	Source	System	DEQ Permit	Permit Fee	COA Permit	Permit Fee
Simple  Complex	Outdoor Irrigation	Laundry	Laundry to Landscape System	Yes	\$90 (includes \$40 annual fee)	No	\$0
	Outdoor Irrigation	Laundry, shower, bathroom sink	Branched Drain System Pumped System Manufactured System	Yes	\$90 (includes \$40 annual fee)	Yes	\$40 (plus \$15 per fixture)
	Indoor Re-use Toilet Flushing	Laundry, shower, bathroom sink	Toilet Flushing System	No	\$0	Yes	\$40 (plus \$15 per fixture)

* If the system owner submits an annual report to DEQ, the \$40 annual fee will be waived most years.

Laundry to Landscape



Branched Graywater System



Indoor Graywater System

Toilet or urinal flushing

**This activity is regulated by state plumbing code, not DEQ.

Special conditions of use:

- Graywater cannot originate from kitchen sinks
- Requires use of “off-the-shelf” and pre-designed system

Permitting:

- Local plumbing permit
- <http://www.permitsprotect.info/>



Residential Graywater Applications

CITY OF
ASHLAND



The Permit Process for

OUTDOOR



Applications

CITY OF
ASHLAND



The Permit Process for

INDOOR



Applications

Graywater System Tier 1:

- Single family residences and duplexes with up to four bedrooms
- 300 gallons per day
- Cannot store for more than 24 hours
- Subsurface irrigation of landscape plants or compost. (Drip System)
- Must be covered by at least 2 inches of soil or mulch and cannot surface, pool or runoff.
- DEQ Permit is necessary

Tier 1 Permitting:

- Must apply for the 2401 general permit through DEQ.
- Pay \$90 (\$50 new-permit application fee and \$40 annual fee)
- Agree to follow the permit conditions
- If the permit application and fees are complete, DEQ will notify the permit applicant by email or postal mail that coverage under the permit has been granted.
- A guide to reusing graywater in the landscape is available for Oregon homeowners eligible for coverage under the 2401 general permit.

Graywater Installation Steps

1. **Determine use** – Decide how you want to use graywater.
2. **Pick a location** – Using guidelines in DEQ’s document, verify your graywater reuse site is appropriate.
3. **Estimate your water needs** – Determine how much graywater you need for your chosen use.
4. **Estimate available graywater** - Decide which fixtures from which graywater will be collected. It may not be feasible to capture graywater from every fixture in your house.

Graywater Installation Steps

5. **Design your graywater system-** Design your graywater system, including collection, distribution and reuse.
6. **Document your system** - Create a system design plan and operation and maintenance manual for your system
7. **Apply for a permit from DEQ-** Obtain a permit application from DEQ and apply for a permit. Permit applications and information are available on the DEQ website.
8. **Apply for a permit from the City of Ashland** – It may be necessary depending on the system you choose.

Step 9: Install Your System



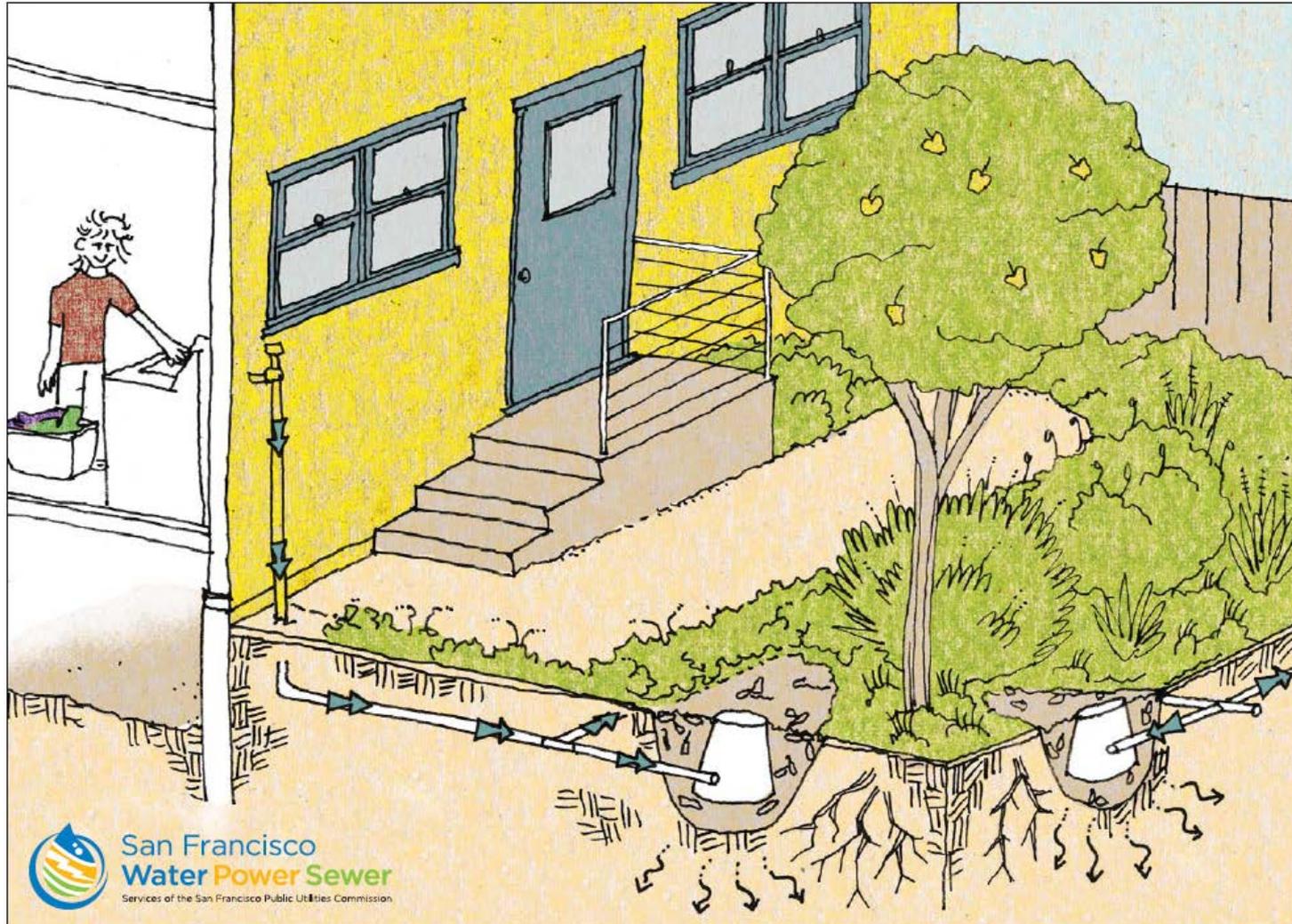
Photos from
*San Francisco
Graywater
Design Manual
for Outdoor
Irrigation*



Step 10: Operate & Maintain

- Only use graywater when you need it
- If the plants need water, give them graywater
- If graywater isn't enough, give them fresh water
- If the plants don't need water, send your graywater to the sewer or septic system
- Do not irrigate when soils are frozen or saturated

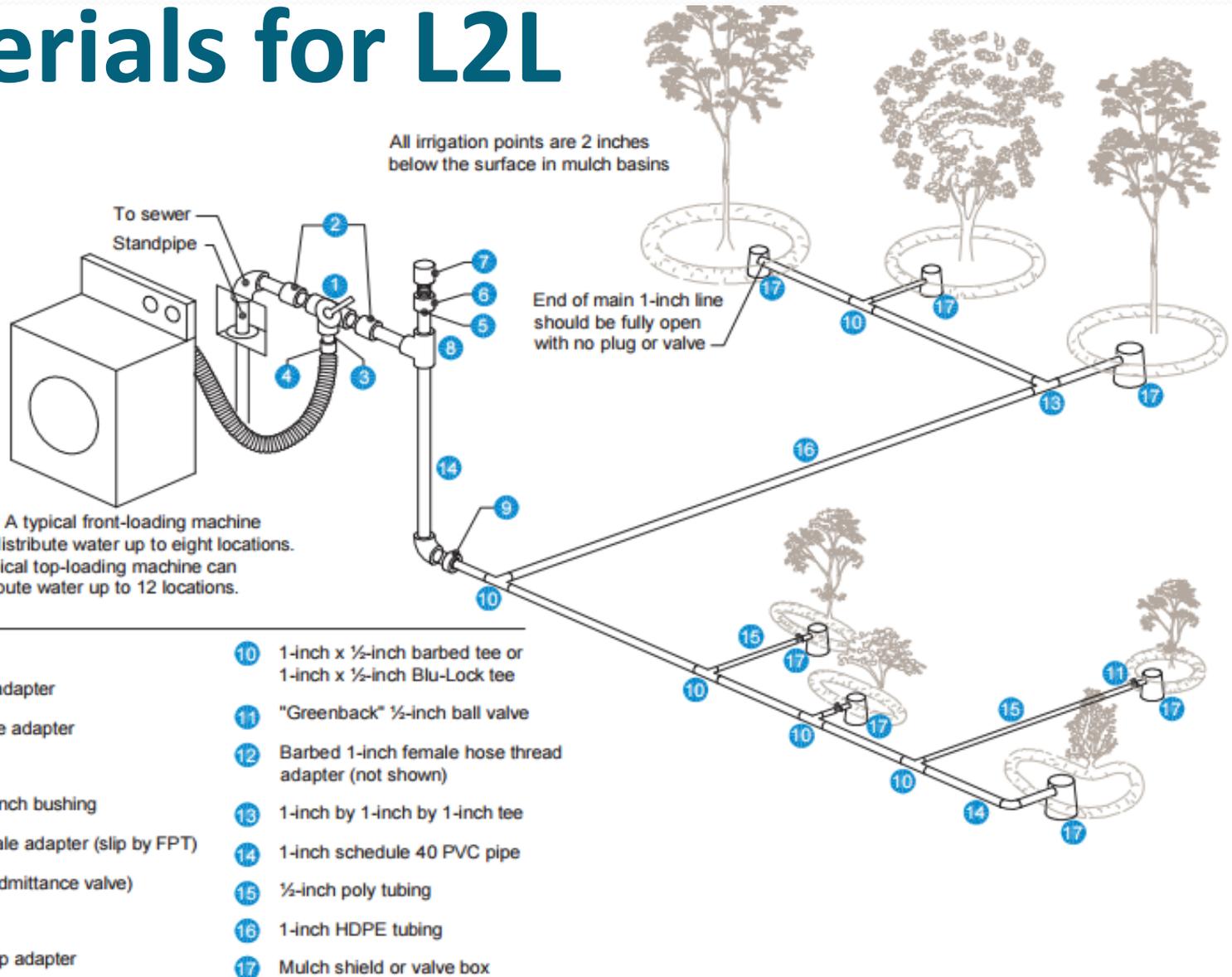




SAN FRANCISCO graywater design manual

for OUTDOOR IRRIGATION

Materials for L2L



Legend

- | | |
|---|---|
| 1 3-way valve | 10 1-inch x 1/2-inch barbed tee or 1-inch x 1/2-inch Blu-Lock tee |
| 2 PVC 1-inch male adapter | 11 "Greenback" 1/2-inch ball valve |
| 3 1-inch barbed male adapter | 12 Barbed 1-inch female hose thread adapter (not shown) |
| 4 Hose clamp | 13 1-inch by 1-inch by 1-inch tee |
| 5 PVC 1-inch x 1 1/2-inch bushing | 14 1-inch schedule 40 PVC pipe |
| 6 PVC 1 1/2-inch female adapter (slip by FPT) | 15 1/2-inch poly tubing |
| 7 Auto vent (or air admittance valve) | 16 1-inch HDPE tubing |
| 8 1-inch PVC tee | 17 Mulch shield or valve box |
| 9 1-inch barbed x slip adapter | |

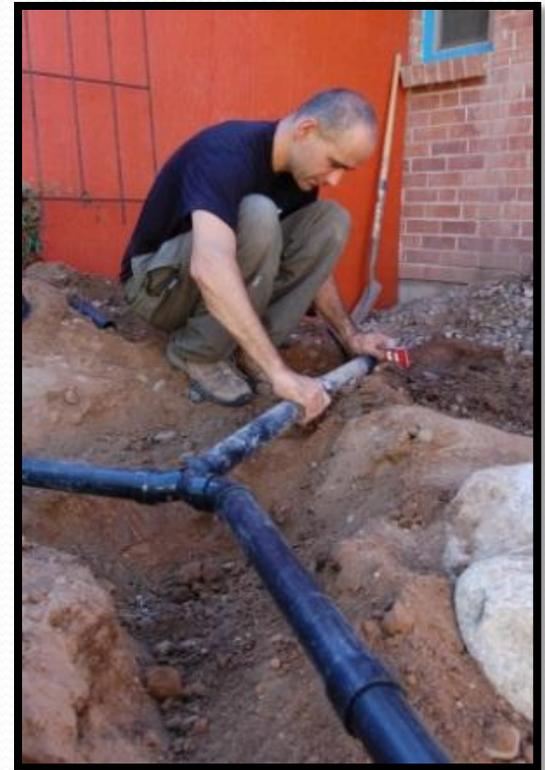
Who Can Install a Graywater System

- Homeowner
- Plumber
- Landscape Contractor



How Much Does it Cost

- Costs range between \$500 - \$2,000
 - Can be as high as \$5,000
- Depends on:
 - The complexity of the system
 - Whether it is a retrofit or new construction
 - If you hire someone to design and do the installation



How Much Can I Save?

- Family of four savings for a 6 month watering season
 - \$50 -\$110 in water bills
 - 17,600 to 34,700 gallons
 - Installing Efficient Appliances and then a graywater system could save up to 50,000 gallons.
 - Sewer \$savings are not included because sewer rates are calculated based on your average winter usage.

Available Graywater for Irrigation Season (May - October)



Washing Machine

Family Size (4)	Usage / Day	Gallons / Month	Gallons / Year	CuFt. / Month	CuFt. for Year	Savings / Month	Savings / Year
40 gal / load 8 loads / week	46	1,391	8,345	186	1,116	\$5	\$27
16 gal / load 8 loads / week	16	488	2,928	65	391	\$2	\$10

- * Using graywater from an inefficient washing machine results in an irrigation savings of 8,344 gallons per season
- * Using graywater from an Energy Star washing machine results in a savings of **2,928** gallons per year
- * Replacing an inefficient washing machine with an Energy Star washer results in a savings of **10,039** gallons per year (SEE PAGE 2)
- * By first installing an Energy Star washing machine then installing a graywater system, estimated savings are approx. **12,967** gallons per season

Showers

Family size (4)	Usage / Day	Gallons / Month	Gallons / Year	CuFt. / Month	CuFt. for Year	Savings / Month	Savings / Year
Showers 2.5gpm	100	3,050	18,300	408	2,447	\$11	\$63
Showers 1.5gpm	60	1,830	10,980	245	1,468	\$6	\$36

- * Using water for irrigation from a shower running 2.5 gpm will result in savings on landscape of 18,300 gallons per season
- * Using water for irrigation from a shower running 1.5 gpm will result in savings on landscape of **10,980** gallons per season
- * Changing a 2.5gpm showerhead to a 1.5 gpm shower head will result in savings of **14,640** gallons per year (SEE PAGE 2)
- * By first installing a lower flow WaterSense showerhead, then installing a graywater system, estimated savings are approx. **25,620** gallons per season

Faucet Aerators

Family size (4)	Usage / Day	Gallons / Month	Gallons / Year	CuFt. / Month	CuFt. for Year	Savings / Month	Savings / Year
Faucet 2.2gpm	44	1,342	8,052	179	1,076	\$4	\$26
Faucet 1.0gpm	20	610	3,660	82	489	\$2	\$12

- * Using water for irrigation from a faucet running 2.2 gpm will result in savings on landscape of 8,052 gallons per season
- * Using water for irrigation from a faucet running 1.0 gpm will result in savings on landscape of **3,660** gallons per season
- * Changing a 2.2gpm faucet aerator to a 1.0 gpm aerator will result in savings of **8,784** gallons per year (SEE PAGE 2)
- * By first installing a lower flow WaterSense faucet aerator, then installing a graywater system, estimated savings are approx. **12,444** gallons per season

Additional Resources

- DEQ
 - <http://www.deq.state.or.us/wq/reuse/graywater.htm>
- Greywater Action
 - <http://greywateraction.org>
- San Francisco Graywater Design Manual
 - <http://sfwater.org/modules/showdocument.aspx?documentid=5>
- Building Code Division
 - <http://www.bcd.oregon.gov/pdf/0990.pdf>

Contacts

- **City of Ashland**

- Michael Genna 541-552-2074
- Julie Smitherman 541-552-2062
- www.ashland.or.us/graywater
- www.ashlandsaveswater.org

- **DEQ**

- Ron Doughten 503-229-5472
- <http://www.deq.state.or.us/wq/reuse/graywater.htm>

