Love Your Water

Graywater Reuse

PNWS-AWWA Conference Vancouver, WA

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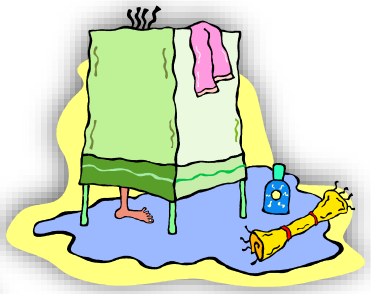
Water Conservation Specialist

May 3, 2019

CITY OF ASHLAND

What is Graywater?

- Graywater **is** water generated from:
  - Showering
  - Clothes Washing
  - Lavatory Faucets



- Graywater **is not** water from:
  - Toilets
  - Kitchen Sinks

Types of Graywater Systems

There are two main types of single-family packaged graywater systems.

1.) Graywater used for toilet flushing

2.) Graywater used for landscape irrigation

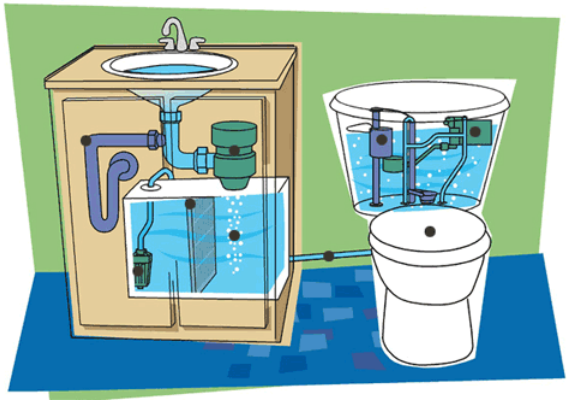


Photo Credit: nachi.org

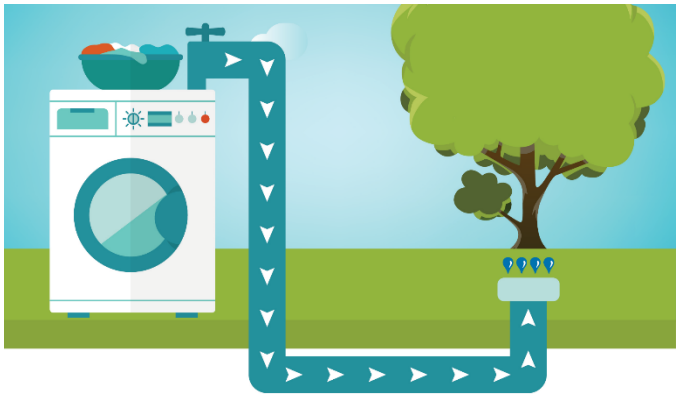
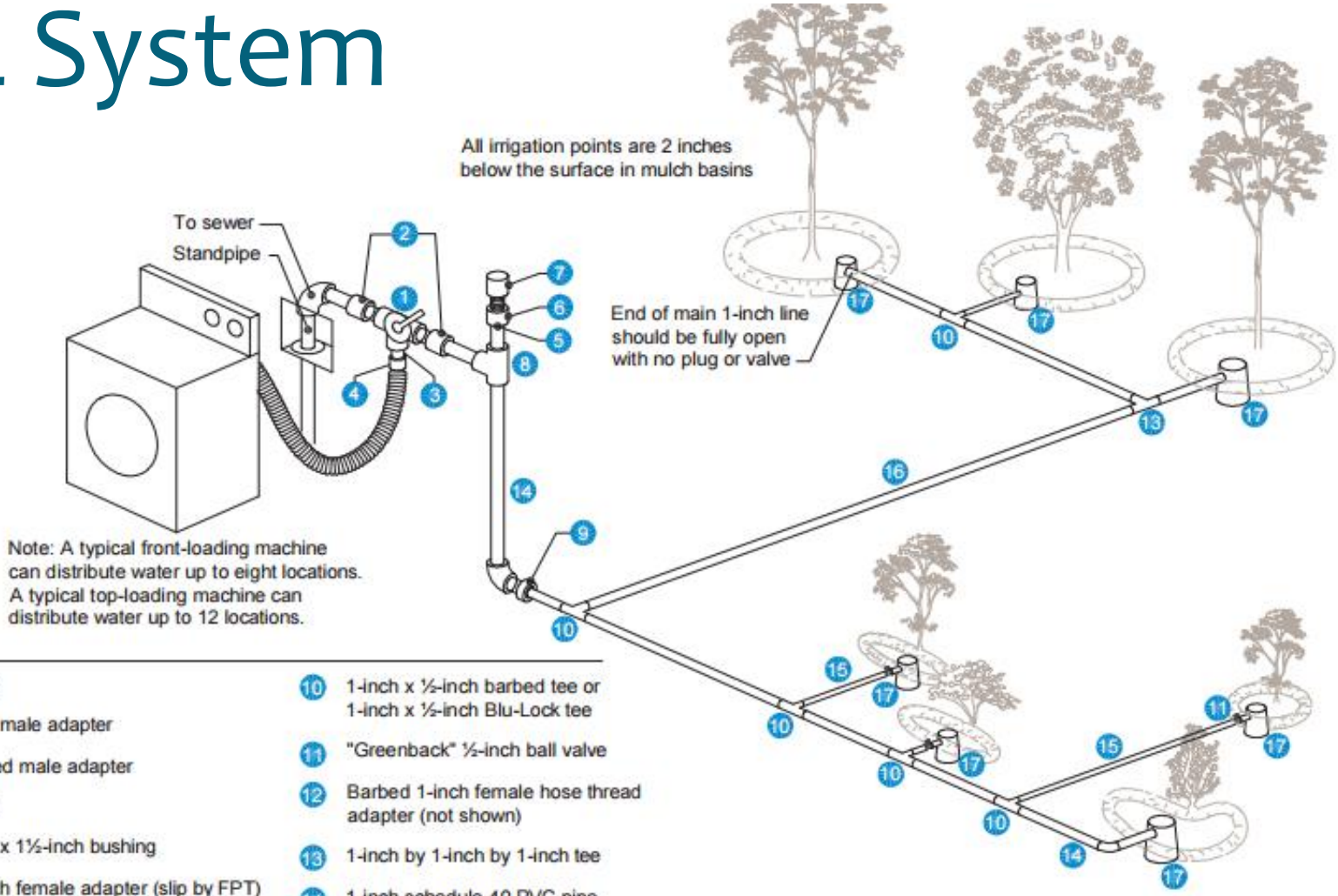


Photo Credit: Pasadena Water & Power

Types of Landscape Graywater Systems

- Laundry to Landscape (L2L)
  - Water from clothes washers discharged to landscape
- Branched Drain
  - Showers, and/or lavatory sinks drain via gravity
  - Laundry can also be included in this design
- Pumped Systems
  - Water from all of the above temporarily stored in a holding tank before being pumped to the landscape

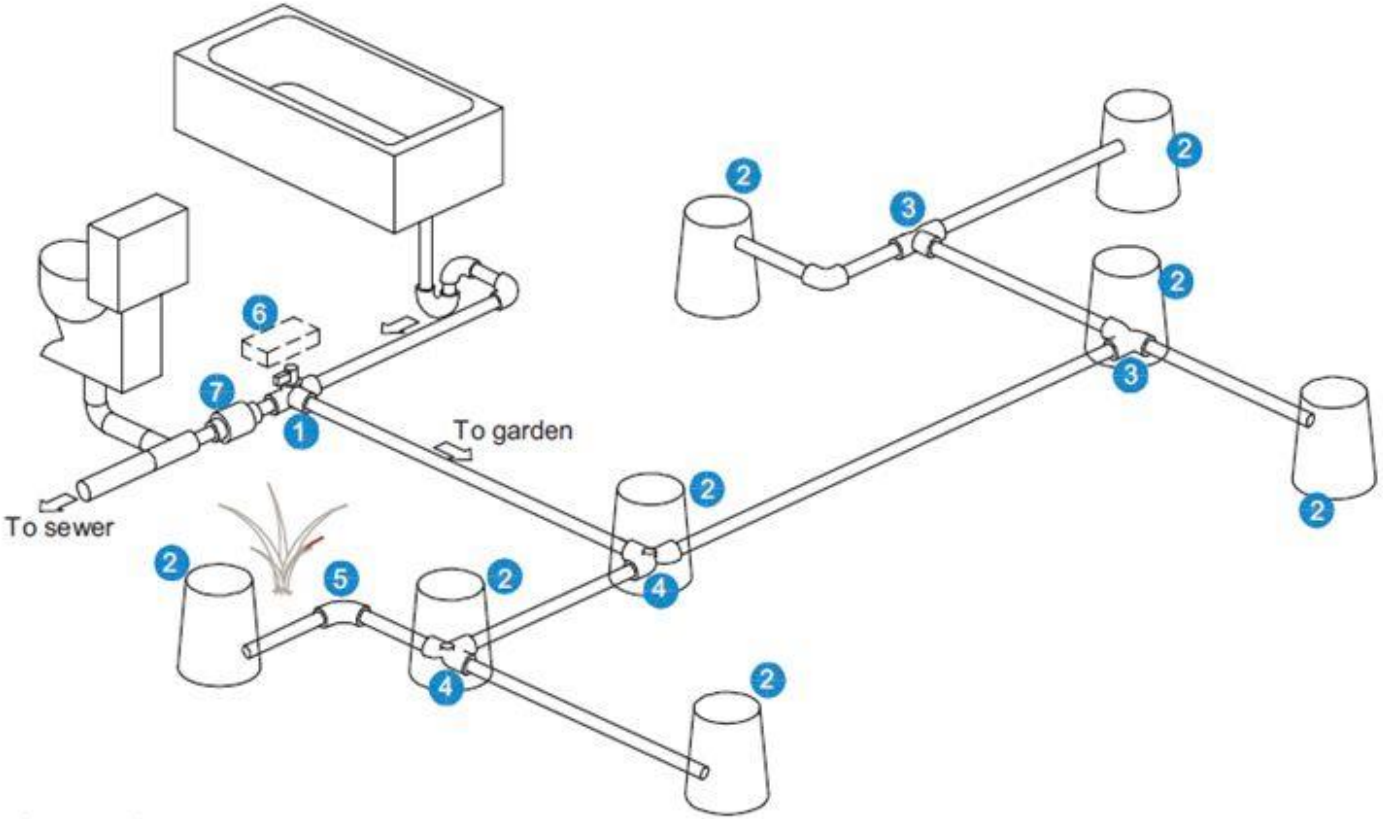
L2L System



Legend

1. 3-way valve
2. PVC 1-inch male adapter
3. 1-inch barbed male adapter
4. Hose clamp
5. PVC 1-inch x 1½-inch bushing
6. PVC 1½-inch female adapter (slip by FPT)
7. Auto vent (or air admittance valve)
8. 1-inch PVC tee
9. 1-inch barbed x slip adapter
10. 1-inch x ½-inch barbed tee or 1-inch x ½-inch Blu-Lock tee
11. "Greenback" ½-inch ball valve
12. Barbed 1-inch female hose thread adapter (not shown)
13. 1-inch by 1-inch by 1-inch tee
14. 1-inch schedule 40 PVC pipe
15. ½-inch poly tubing
16. 1-inch HDPE tubing
17. Mulch shield or valve box

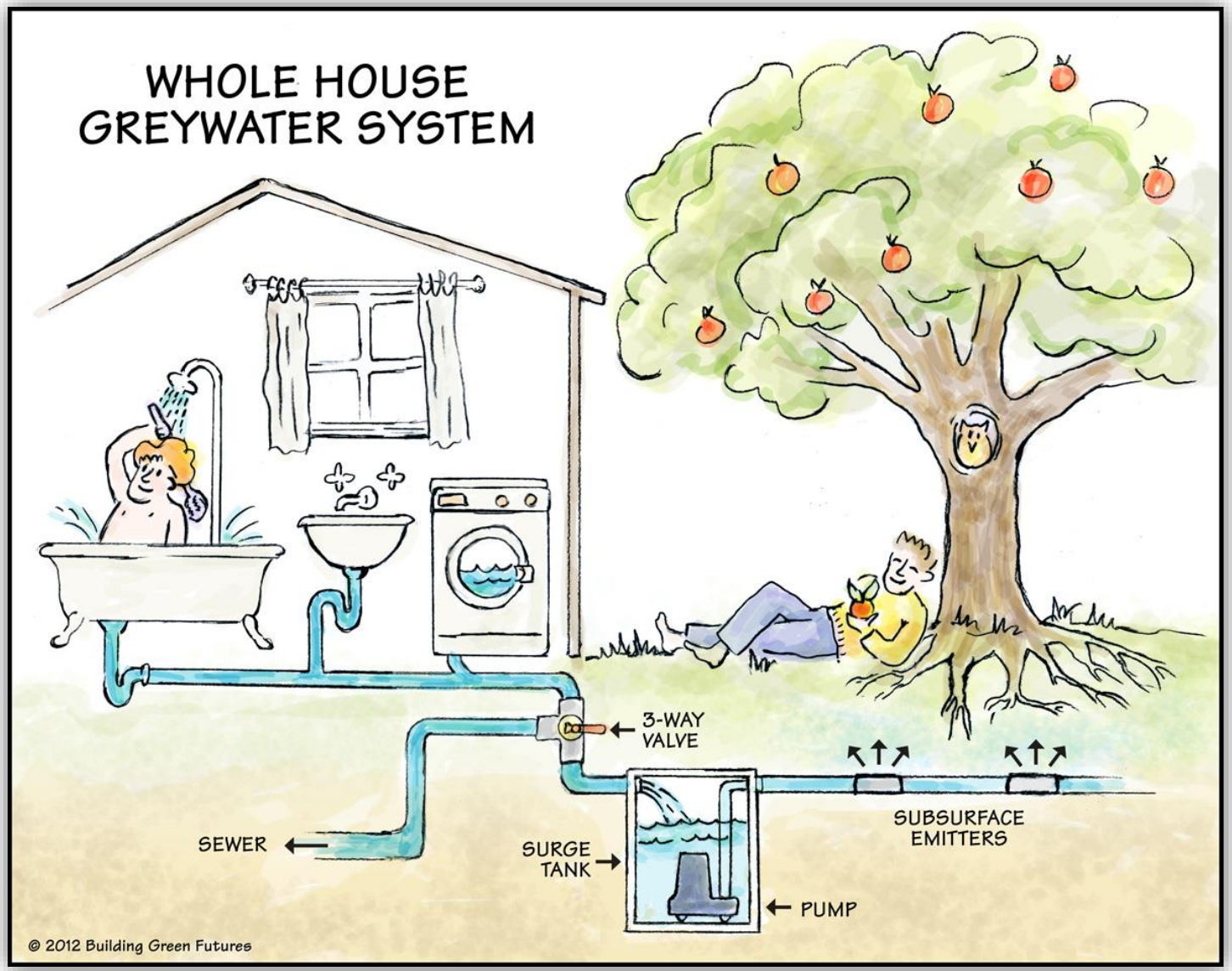
Branched Drain System



Legend

1. 3-way diverter valve
2. 7" round valve box or rigid 3" gallon pot
3. ABS 1.5" or 2" double ell (aka twin 90)
4. ABS 1.5" or 2" double ell (aka twin 90) w/ inspection/ clean-out port
5. 1.5" or 2" long sweep 90° bend
6. Optional 3-way valve actuator
7. Backwater valve

Pumped Graywater System



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.

Graywater System Tier 1

- Can be Laundry to Landscape, Branched Drain, Pumped System
- Single family residences and duplexes
- 300 gallons per day - cannot store for more than 24 hours
- Subsurface irrigation of landscape plants (Drip System)
- Irrigation must be covered by at least 2 inches of soil or mulch and cannot surface, pool or runoff.
- DEQ Permit is necessary- Pay $93 and $41 annual fee

Tier 1 Graywater Systems

Simple → Complex

Application	Source	System	DEQ Permit	Permit Fee	COA Permit	Permit Fee
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.**

2401 Tier 1 Permit

For DEQ Use Only
Date Permit Issued
File No.

State of Oregon
Department of Environmental Quality
700 NE Multnomah St, Suite 600
Portland, OR 97232

Application to Renew 2401 Tier 1 Graywater Reuse and Disposal System WPCF General Permit

For DEQ Use Only
Date
Amount Received
Check No.

Permit Registrants must complete this form prior to February 28 to ensure permit coverage following the expiration date. The applicant must provide all requested information for this application to be considered complete. An application that is incomplete or unsigned will be returned to the applicant to complete.

A. APPLICANT NAME AND CONTACT INFORMATION			
1.	Legal name of applicant:		
2.	Is the applicant the owner of the property? ◯ Yes ◯ No		
3.	◯ Email:	Telephone:	
	◯ No email address or do not wish to correspond by email.		
4.	Mailing address:		
	City:	State:	Postal Code:

B. GRAYWATER REUSE AND DISPOSAL SYSTEM INFORMATION
LOCATION OF SYSTEM (POINT OF GRAYWATER GENERATION)

Annual Report

State of Oregon
Department of Environmental Quality
700 NE Multnomah St, Suite 600 Portland OR 97232

Annual Report Graywater Reuse and Disposal System General Permits

For DEQ Use Only

This annual report describes the operation and maintenance of a graywater reuse and disposal system covered under the general permit during the calendar year. **This annual report must be submitted to DEQ by all 2402 permit holders. For all 2401 permit holders, this annual report may be submitted to DEQ instead of the $40 annual compliance fee.**

Send completed annual report to:
Oregon Department of Environmental Quality
Attn: Graywater Program Coordinator
700 NE Multnomah St, Suite 600
Portland OR 97232

Select Type of Permit: ☐ **2401** ☐ **2402**

Rebates or Resources

- Requested by community organizations/commissions
- Reviewed benefits of a rebate program vs educational program
  - Cost benefit analysis
- Most cost effective was to offer resources such as workshops and online information
- Workshop focus: landscape graywater system
- Under the tier one Oregon DEQ requirements
- Makes the most sense for homeowners, least expensive

Workshops

- Homeowners, Landscapers & Plumbers
- Minimal attendee cost
- City covered most of the cost
- Graywater book for attendees
- CEUs for contractors
- Lunch provided by sponsor (SOLA)
- Graywater example nearby

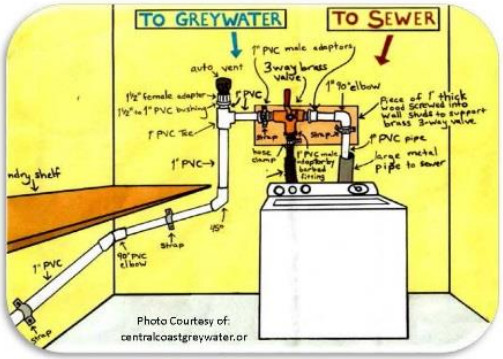
Graywater Workshop

Calling ALL Landscape and Plumbing Professionals!

Location: Southern Oregon University, Stevenson Union Room 319

Date: May 19, 2018 **Time:** 9:30 a.m. - 4 p.m. **Cost:** $35/person

Interested in installing a graywater system for your customers? Join us to learn the basics about how these systems work!



Local experts will be on hand to:

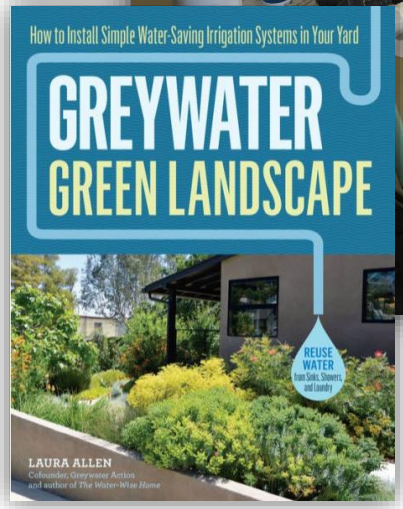
- Demonstrate how systems are designed, installed and operated
- Display materials needed to build your own graywater system
- Discuss local and state building codes & permits

Part of the workshop will be held outside, so please wear appropriate clothing and closed-toe shoes.

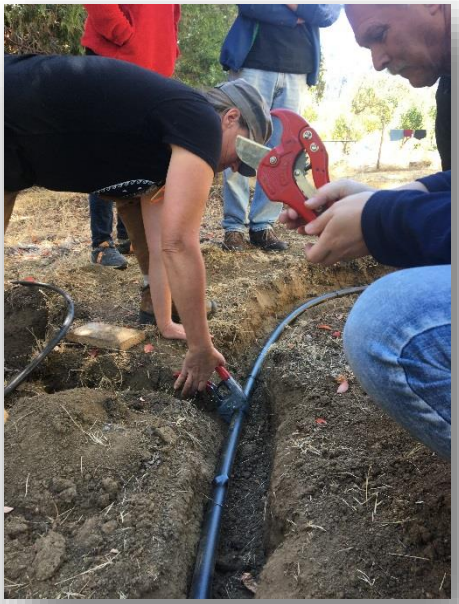
- **Workshop qualifies for CEUs.**
- **Lunch will be provided**

RSVP to julie.smitherman@ashland.or.us or 541-552-2062 by May 11th 2018

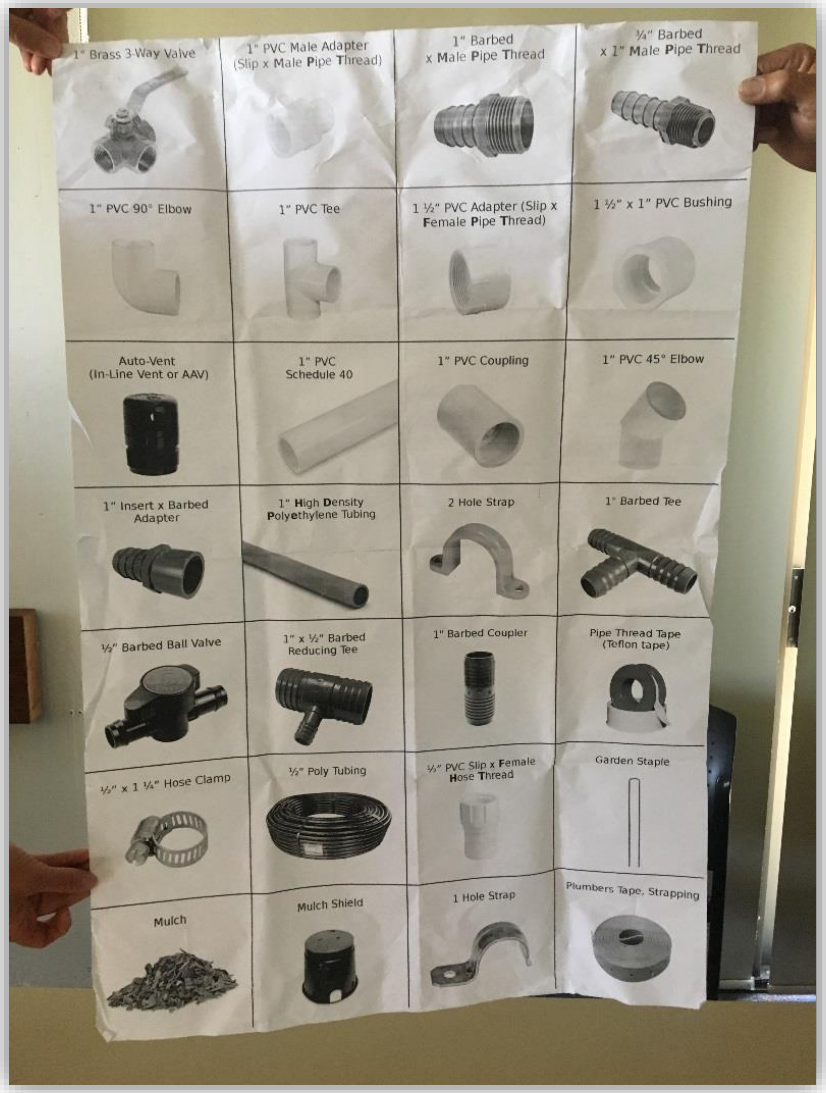
Graywater Workshops



Installation Workshops



Laundry to Landscape Materials



Diverter Valves in Action

Testing the System

How Much Does it Cost

- Costs range between $500 - $2,000
  - Can be as high as $5,000
- Determining Factors:
  - 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 Graywater Do I Produce

CITY OF ASHLAND

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	3.0	21.0	42.0	84.0
	Older than 1980	5.0	3.0	15.0	30.0	60.0
	1980 - 1994	3.0	3.0	9.0	18.0	36.0
	1994 or newer	2.5	3.0	7.5	15.0	30.0
	Standard	2.2	3.0	6.6	13.2	26.4
	WaterSense	1.5	3.0	4.5	9.0	18.0
	WaterSense	1.0	3.0	3.0	6.0	12.0
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*

How Much Can I Save?

- Family of four potential savings
  - Laundry to Landscape $10 -$30 per year
  - 2,000 - 8,000 gallons
  - Branched Drain System $45-$65
  - 10,000 – 15,000 gallons
  - Sewer savings are not included, sewer rates are calculated based on average winter usage.
  - Installing Efficient Appliances could save even more. Sewer savings would be included.

What Impacts Cost Savings

- **Climate:** Savings will be lowered if a graywater system is installed in a location where irrigation is required for fewer than 12 months per year

- **Weather:** Even during the irrigation season there are likely to be days when precipitation provides all or part of required irrigation

- **Accuracy and Timing limitations:** It is unlikely a homeowner would accurately calculate balance irrigation demands and graywater availability on a daily basis

Savings in Gallons

Equation 5a: Laundry-to-Landscape System Annual Household Savings, gallons

6.5 gcd x pph x irrigation season (days/year)

Equation 5b: Branched Drain System Annual Household Savings, gallons

8.0 gcd x pph x irrigation season (days/year)

Equation 5c: Pumped System Annual Household Savings, gallons

14.5 gcd x pph x irrigation season (days/year)

Potential Cost Savings

Table 7a. Laundry-to-Landscape Graywater System Net Annual Household Cost Savings

Persons per Household	***Annual Water Savings (gallons)***	***Volumetric Rate per 1,000 gallons***						
		$2	***$5***	***$8***	***$11***	***$14***	***$17***	***$20***
1	1,781	$4	$9	$14	$20	$25	$30	$36
2	3,562	$7	$18	$28	$39	$50	$60	$71
3	5,343	$11	$27	$43	$59	$75	$91	$107
4	7,124	$14	$36	$57	$78	$100	$121	$142
5	8,905	$18	$44	$71	$98	$125	$151	$178
6	10,686	$21	$53	$85	$117	$149	$181	$214

Example Calculation: 3 pph, 274-day irrigation season, volumetric rate of $14/1,000 gallons, $0 per year O&M costs

5,343 gal/year x $14/1,000 gal - $0/year O&M = $75/year net savings

Payback Period

Table 9a. Do-it-Yourself Laundry-to-Landscape Payback Period in Years (@$185)

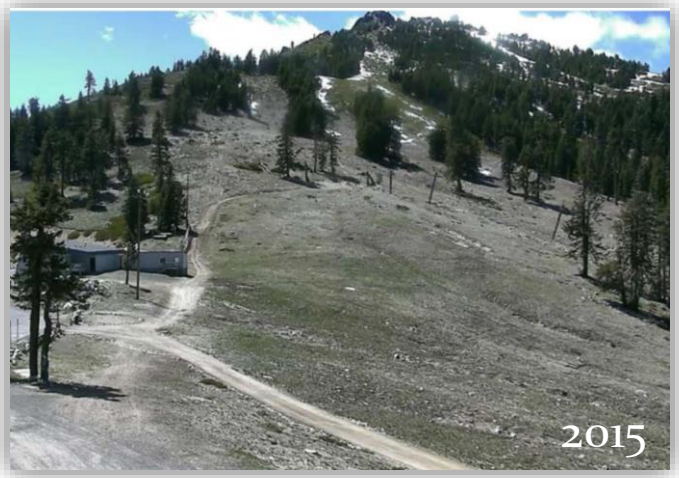
Persons per Household	Annual Water Savings (gallons)	Volumetric Rate per 1,000 gallons						
		$2	$5	$8	$11	$14	$17	$20
1	1,781	52	21	13	9	7	6	5
2	3,562	26	10	6	5	4	3	3
3	5,343	17	7	4	3	2	2	2
4	7,124	13	5	3	2	2	2	1
5	8,905	10	4	3	2	1	1	1
6	10,686	9	3	2	2	1	1	1

Example Calculation: 3 pph, 274-day irrigation season, volumetric rate of $14/1,000 gallons.

$185 installed cost ÷ $75 /year net savings (Table 7a) = *2 years*

Why Use Graywater

- Utility Rates are going to continue to increase
- Climate change could increase length of summer irrigation season
- Drought is becoming more frequent and water supplies are becoming more stressed
- Less stress on sewer system
- It's the right thing to do – Every Drop Counts



Customer Cost Savings

- High marginal volumetric water
- Long irrigation season
- Home has high occupancy rate
- Lower installed costs
- Lower operational and maintenance costs
- Do it Yourself Graywater system
- Installed during home construction vs. retrofit

Challenges

- Cross connection concerns
  - Requiring a backflow device
- City Department Coordination
  - New to City Departments
  - Meetings between Water & Building Department / Plumbing Inspectors
  - Developing inspection process and BMPs
- Where are the graywater systems installed in our City?
  - No permit required for L2L.
  - What about branched drain or pumped systems?
  - Contact DEQ and they will send you a list of addresses
- How much water is actually being saved
  - Some homes end up using more water than before

Additional Resources

- Oregon Department of Environmental Quality
  www.deq.state.or.us/wq/reuse/graywater.htm
- Alliance for Water Efficiency – Graywater Systems
  www.allianceforwaterefficiency.org/graywater-reuse-systems-report.aspx
- State Building Code Division
  www.bcd.oregon.gov/pdf/0990.pdf
- Greywater Action
  www.greywateraction.org
- San Francisco Graywater Design Manual
  www.sfwater.org/modules/showdocument.aspx?documentid=5

Thank You & Questions

City of Ashland

Julie Smitherman 541-552-2062

www.ashland.or.us/graywater

www.ashlandsaveswater.org

DEQ

Pat Heins 503-229-5749

www.deq.state.or.us/wq/reuse/graywater

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.

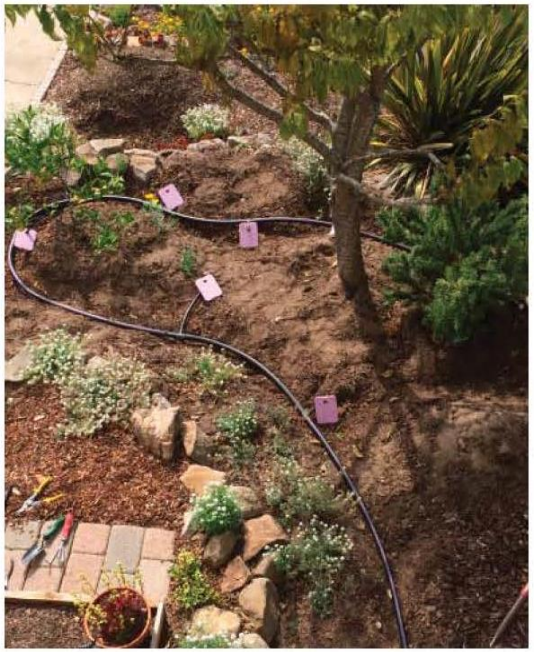
8. **Apply for a permit from the City of Ashland** – It may be necessary depending on the system you choose.

Step 9: Install Your System

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

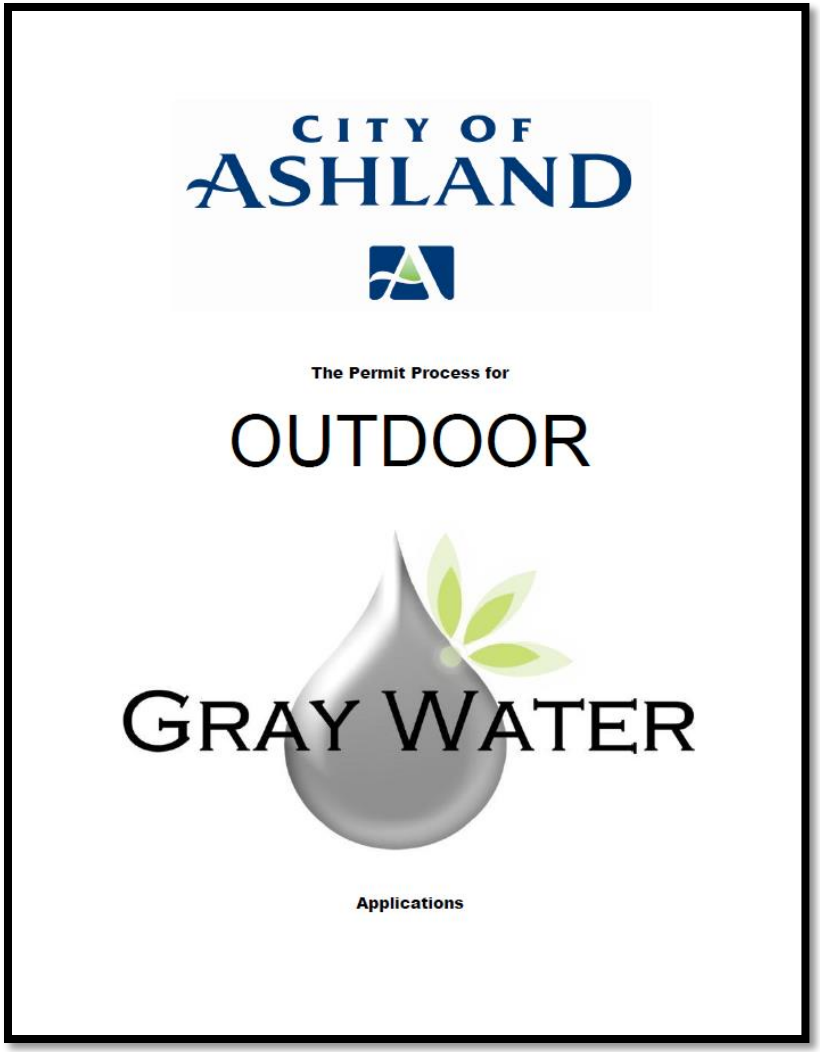
Step 10: Operate & Maintain

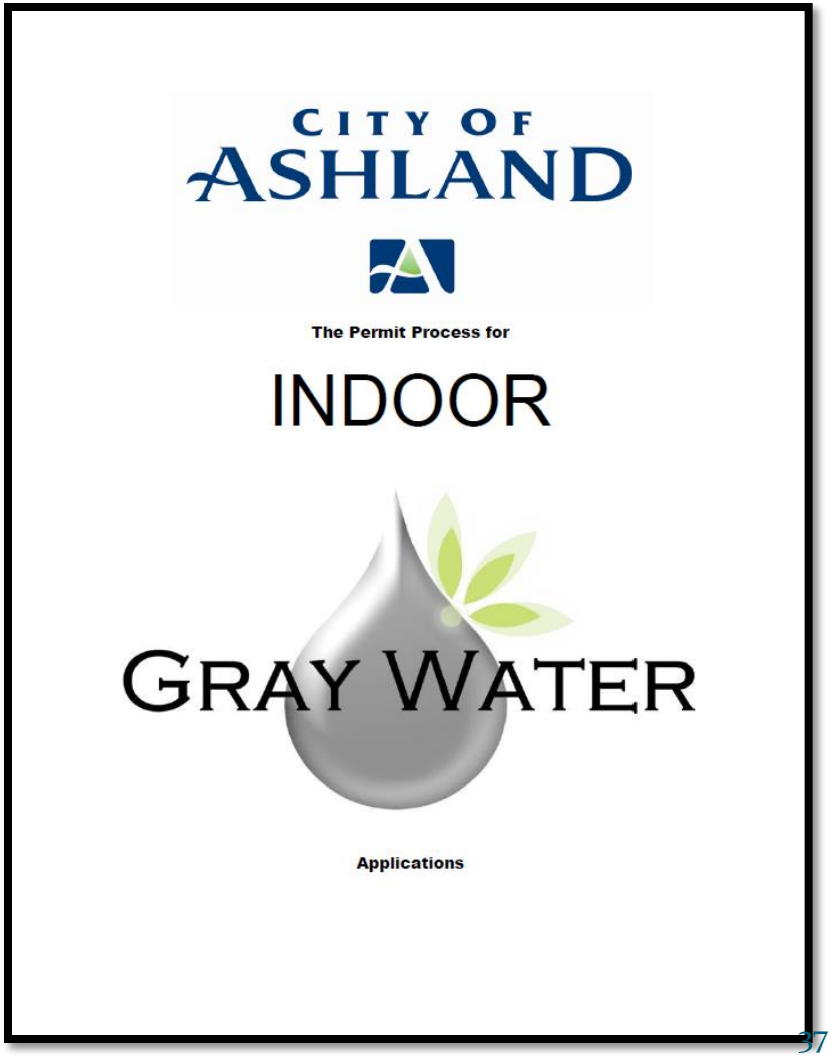
- Only use graywater when you need it
- If the plants need water, give them graywater
- If graywater isn't enough, give them fresh water
- If the plants don't need water, send your graywater to the sewer or septic system
- Do not irrigate when soils are frozen or saturated



SAN FRANCISCO graywaterdesignmanual for OUTDOOR IRRIGATION

Residential Graywater Applications





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**

ecology center

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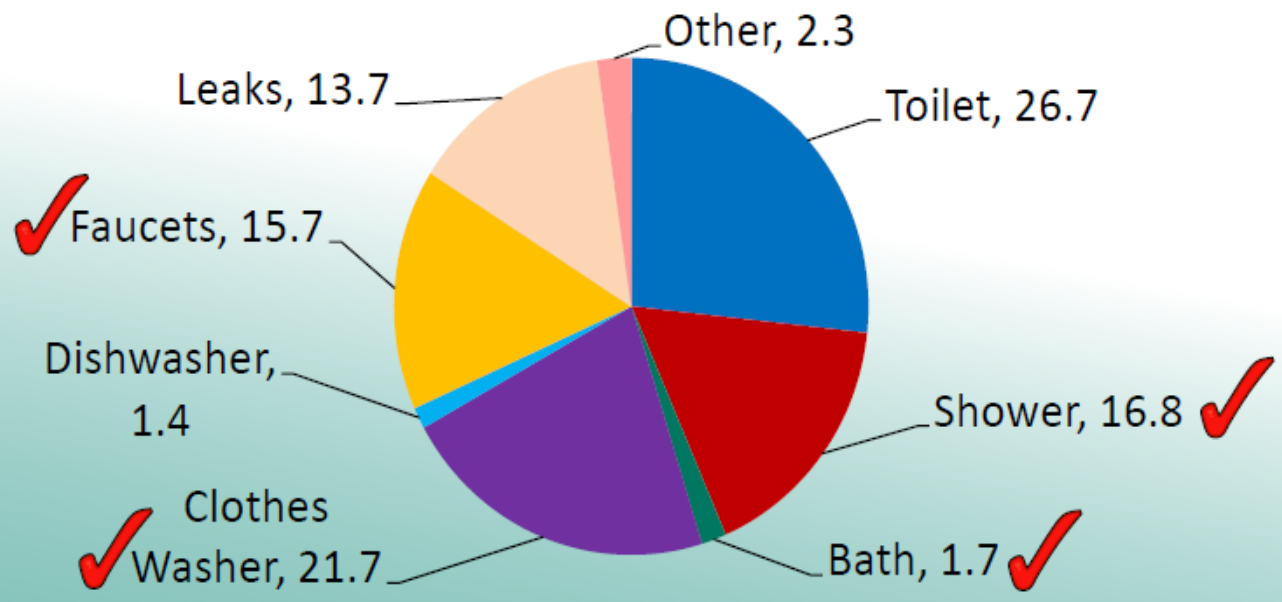
Greywater-Compatible Cleaning Products

Best	Limit	Avoid
Oasis Laundry Liquid	Citra Suds (sodium chloride)	Tide (enzymes +?)
Bio Pac Laundry Liquid	Biokleen Laundry Liquid	All (perfume, brightening agent, colorant, +?)
ECOS liquid detergents	Planet (salt, sodium carbonate/washing soda)	Arm & Hammer (water softener, brightener, +?)
Hydrogen Peroxide bleach	Ecover Laundry Wash (some salt)	Woolite (?)
Vaska Herbatergent	Mountain Green Laundry Detergent	Ivory Snow (enzymes +?)
	LifeTree Laundry Liquid	Clorox (chlorine bleach)
	Lullwater Soap Nuts Seventh Generation (enzymes)	Borax
	Biokleen Bac Out (sodium percarbonate, enzymes)	
	Biokleen Oxygen Bleach Plus (sodium sulfate)	

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.)