(all about)

Greywater

(and especially)

“Laundry to Landscape”

with
Christina Bertea
Greywater Action

October 25, 2016

your instructor:

christina bertea

greywater action instructor 8+ years
http://greywateraction.org
eco-artist
http://weadartists.org/artist/christina-bertea
natural builder
union trained journeywoman
plumbing contractor

making sure
we have
enough water
for all
by teaching
sustainable
water practices!

find helpful landscape information at:

www.bayareagardening.org

BAWSCA
Bay Area Water Supply & Conservation Agency

welcome!

~why greywater?
~survey of types of systems
activity
~focus on Laundry to Landscape:
system details/ how to
break
~This Old House video
~plumbing terminology
~parts match
~system mock up
~review

California's uncertain water future:

* population pressures

* climate change risks
  ~unpredictable precipitation
  ~decreasing snow pack

* natural disaster risks
  ~earthquake/ vulnerable delta
  ~sea level rise
* predicted 99 year drought in the west

scarcity or not:

our municipal water has a carbon footprint!

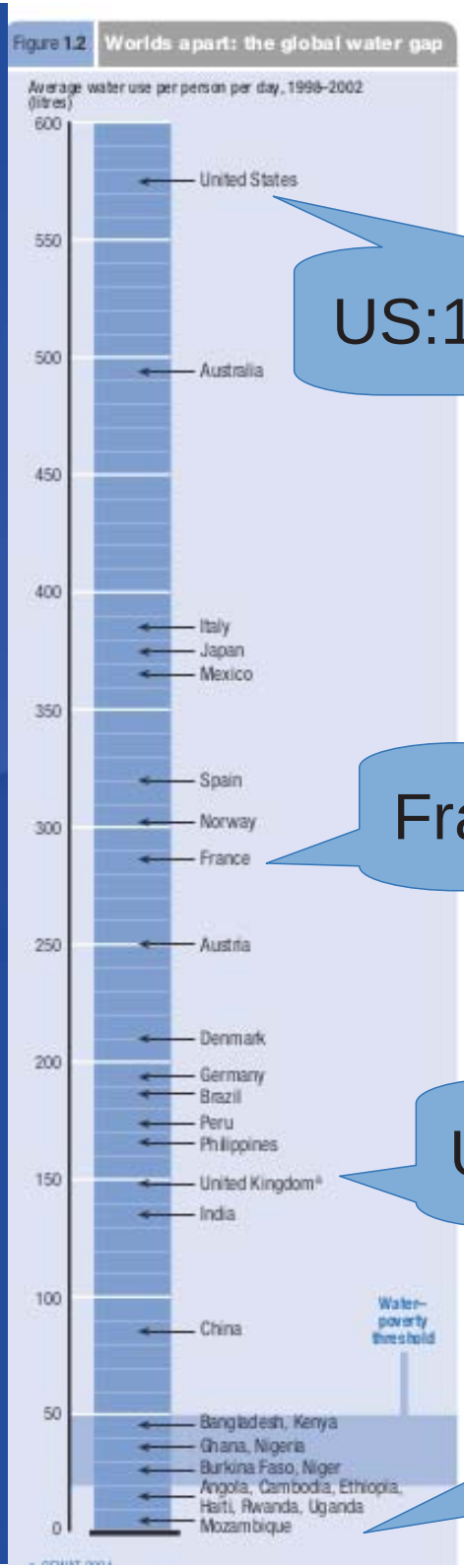
19% of all energy used in CA is related to water

re-using water already used (& paid for) reduces the embodied energy per use

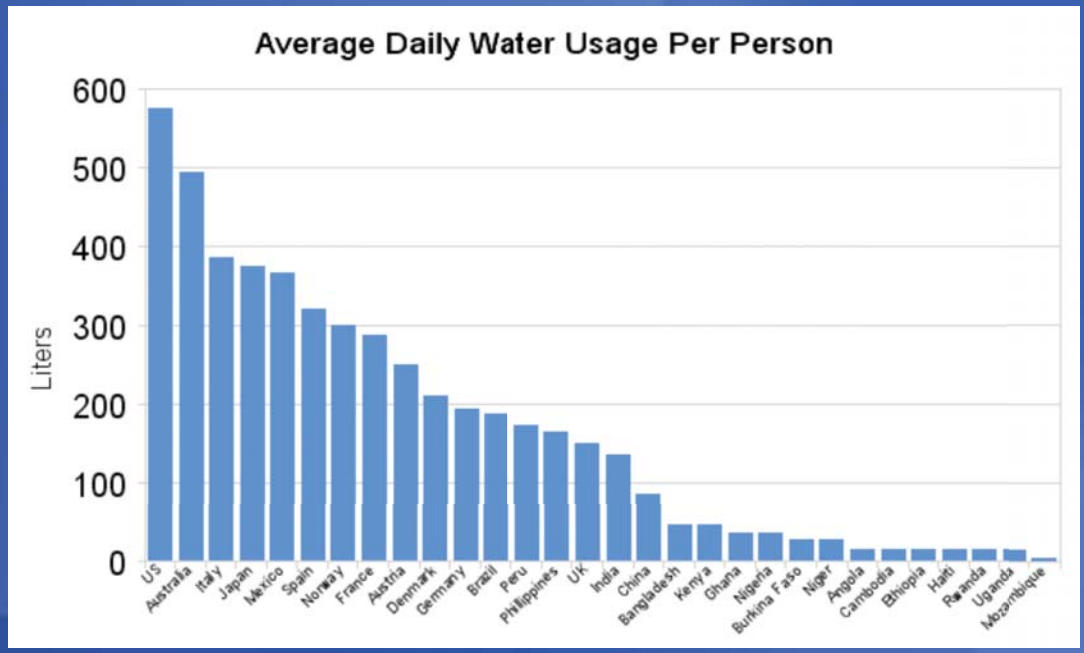
our energy use
contributes to
climate change

impacting water availability
around the world

rural women & children
already spend
200 million hours per day
fetching water
according to UN Women estimate



US:150 gal/person



France:76 gal/person

the global water gap

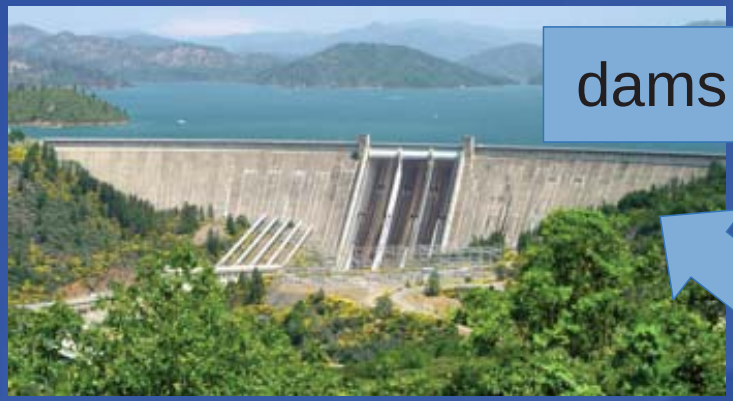
UK: 40 gal/person

remember to start with conservation before reusing greywater

Mozambique
1 gal/person

Source: UNDP Human Dev. Report 2006

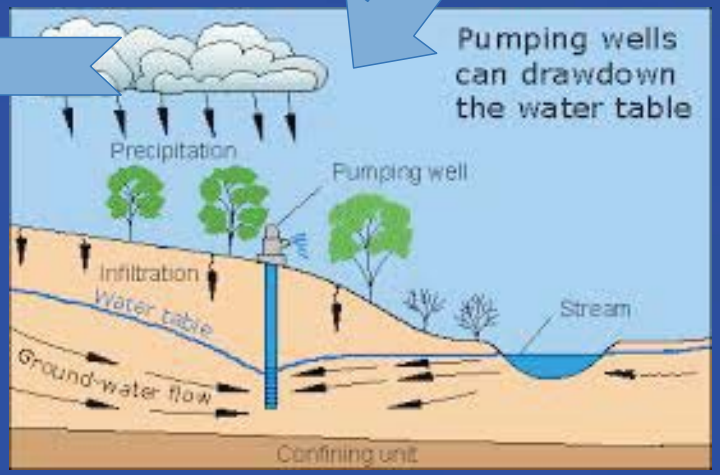
hidden costs of water



dams, damaged rivers

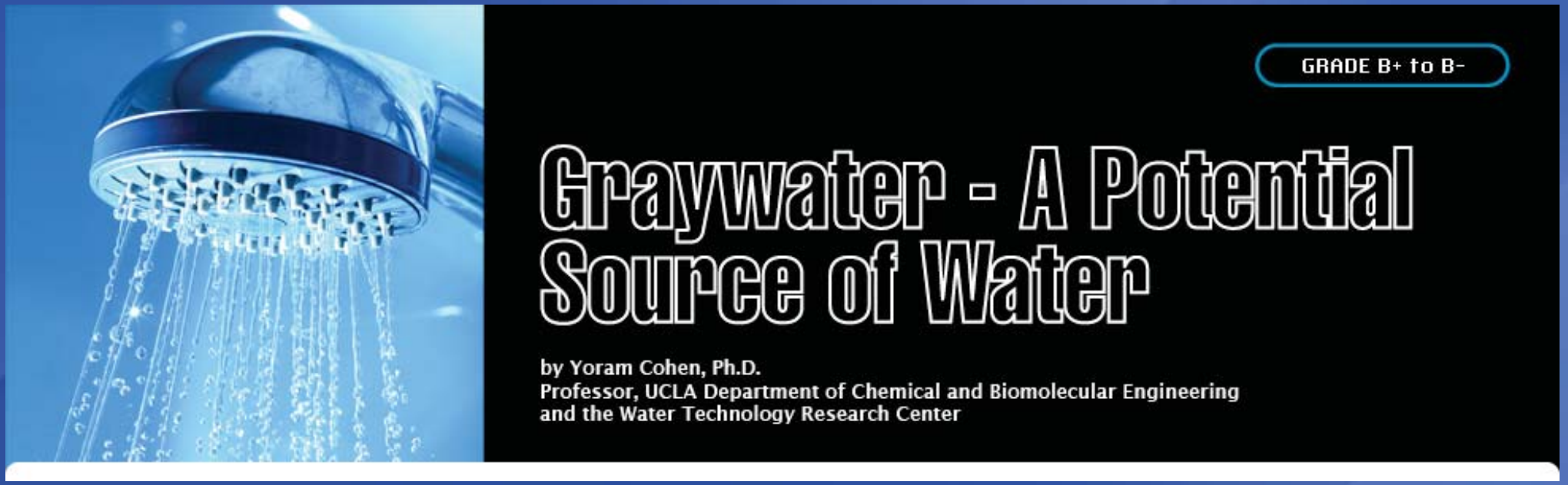
Image: Elizabeth Dougherty

overdrawn aquifers, subsidence, dry wells



climate change

dry rivers



"water recycling, particularly of graywater, is now being advanced as a potential water source that could alleviate some of the water shortage pressure…"

greywater is~

wastewater from

* washing machines
* sinks
* bathtubs and showers

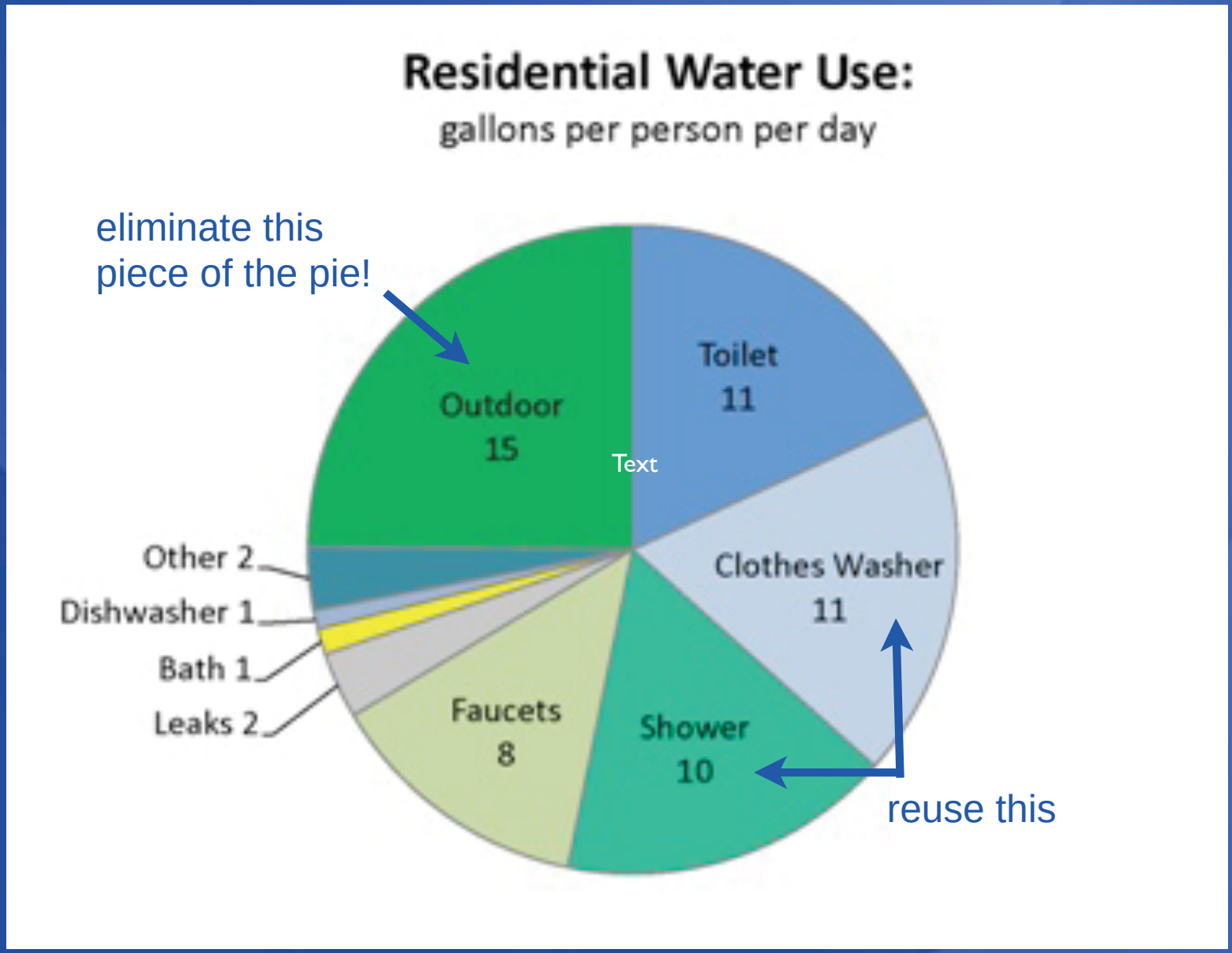
blackwater is~

wastewater from

* toilets
* laundry water with fecal matter/toxins

kitchen sinks & dishwashers= “dark greywater”

in santa cruz:



greywater can decrease potable water use by 16-40% depending on the site

is it legal to re-use greywater?

greywater codes vary state to state

2010: California's Plumbing Code was updated & made more effective

greywater may now be dispersed in **mulch basins**

laundry to landscape systems do not require a permit if 12 guidelines are followed

food may be grown so long as soil doesn't touch edible portion of plant

groundrules for greywater re-use

* avoid contact with people or domestic animals
* no above ground spraying or sprinkling
* no surfacing, ponding or runoff
* no storing for more than 24 hours
* irrigation or disposal field may be a mulch basin
* discharge point covered with 2” of mulch, gravel, soil or a solid shield

groundrules....

* valve to allow diversion back to sewer or septic
  --if washing soiled diapers or toxic chemicals
  --if water table elevated
  --if soil saturated with rain

* valve clearly labeled

* operating/maintenance manual that stays with house

* no toxins down the drain--careful choice of products

* greywatered soil cannot touch edible part of plant

some benefits of using greywater:

- offsets potable water use
- conserves energy (used to transport, clean and treat water)
- encourages healthy product choices
  - Helpful website: www.cosmeticdatabase.org
- facilitates home-grown food production
- connects people to their yards
- reduces demand on septic systems and wastewater treatment plants

the EPA says

860 billion gallons of untreated sewage

overflow into US water ways each year.

so even if you have one...
treatment plants don't always do their job

diy informal greywater use
lowest tech: the humble bucket

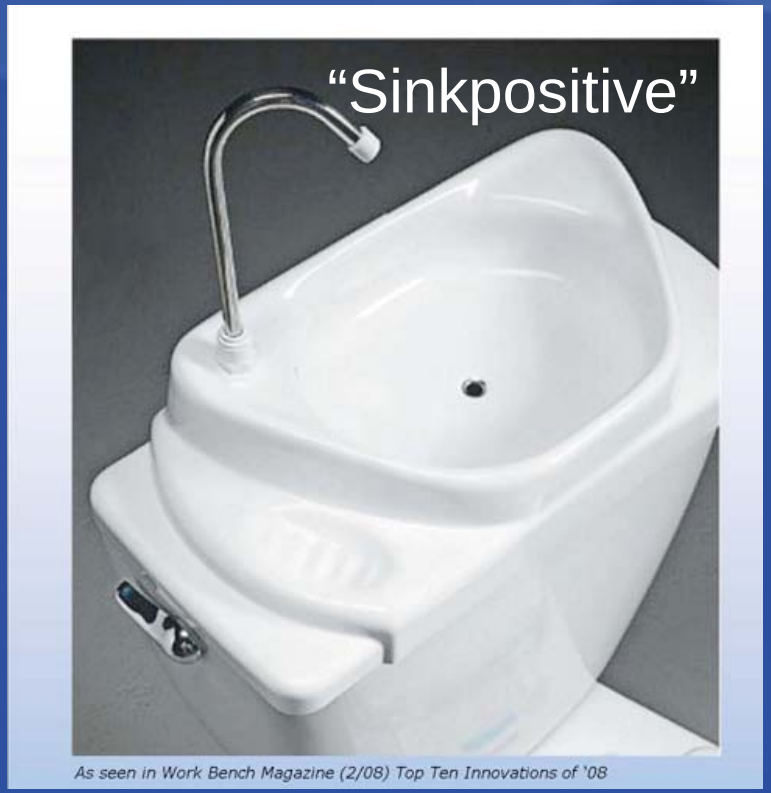
- collect cold water until shower heats up-- pour into toilet bowl to flush
-
- use a dishpan in sink to collect wash water--
- carry outside to water the garden

bathroom sinks:
~disconnect the trap
~use greywater
to flush the toilet

tank lid sinks:

tank refill water becomes greywater as hands are rinsed

greywater is then “reused” to flush the toilet



homeowner creativity:

utility pump pushes tubwater to garden

renter's laundry drum system
(not to code)

Laundry hose put out window

30-50 gallon food grade drum
"surge tank"...
does not store greywater

Greywater gravity
flows out garden hose
(no shut off)

ways to use greywater

* outdoors: low tech / landscape direct
  no pumps, filters, or connection to other irrigation systems or potable water

* outdoors: high tech / drip irrigation
  tanks, filters, pumps, automatic backflushing

* indoors: toilet flushing/ clotheswashing
  tanks, filters, disinfection, pumps

landscape direct systems

no added pump
no tanks, no filters
distribute greywater directly into:

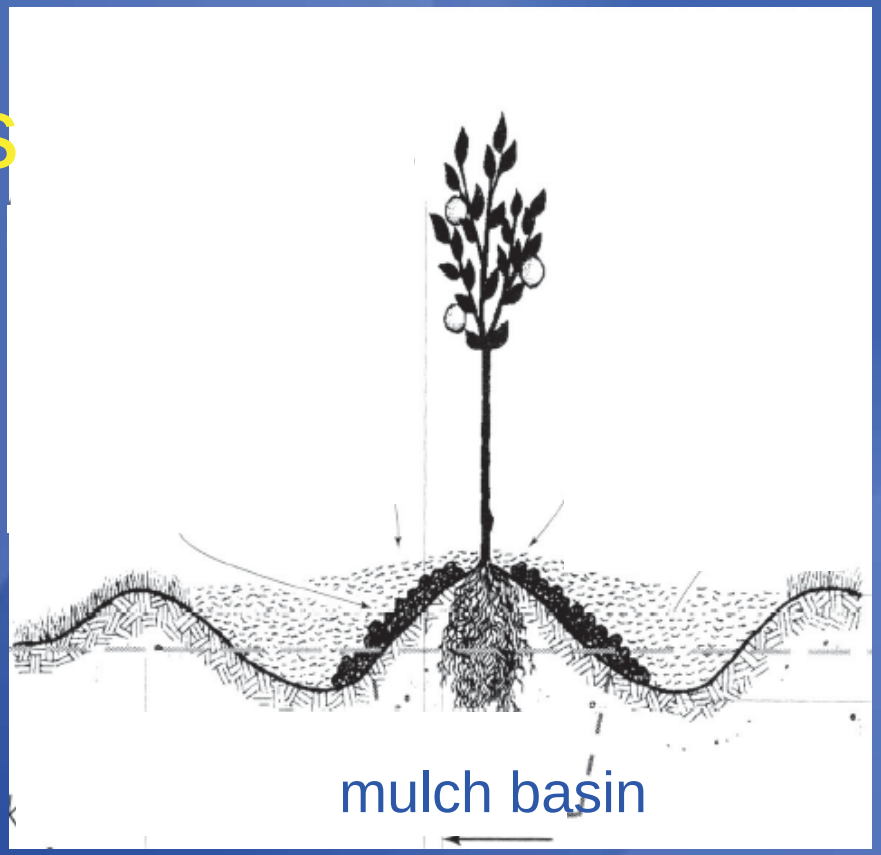


image from “Create and Oasis with Greywater” by Art Ludwig

“Mulch Basin.
A type of irrigation or disposal field filled with mulch...
of sufficient depth, length and width to prevent ponding or runoff...”

filled with:

“Mulch.
Organic waste material including but not limited to leaves, prunings, straw, pulled weeds and wood chips. ...
permeable enough to allow rapid infiltration of graywater.”

(code language)

freshly dug mulch basin

adding mulch:
the coarser the better

landscape direct is best for
trees
shrubs
large plants

not appropriate for:
lawns
groundcovers
beds with many small plants

greywater is delivered
to the mulch basin in a
“mulch shield”

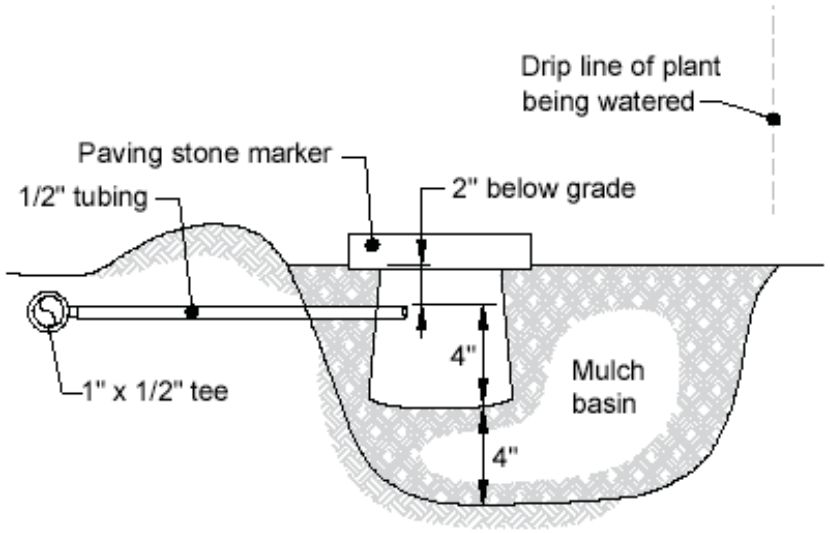


Figure 4. Mulch shield placement.

greywater exits pipe
2” below solid shield / lid

water freefalls thru air
onto mulch
then spreads in basin

no root entry
no clogging

re-using washing machine greywater:

laundry to landscape system

low tech / landscape direct
uses the pump in the washer to
push greywater to the garden

if 12 guidelines are followed
no permit is required since
plumbing is not altered

laundry to landscape system "L2L"

no alteration to plumbing

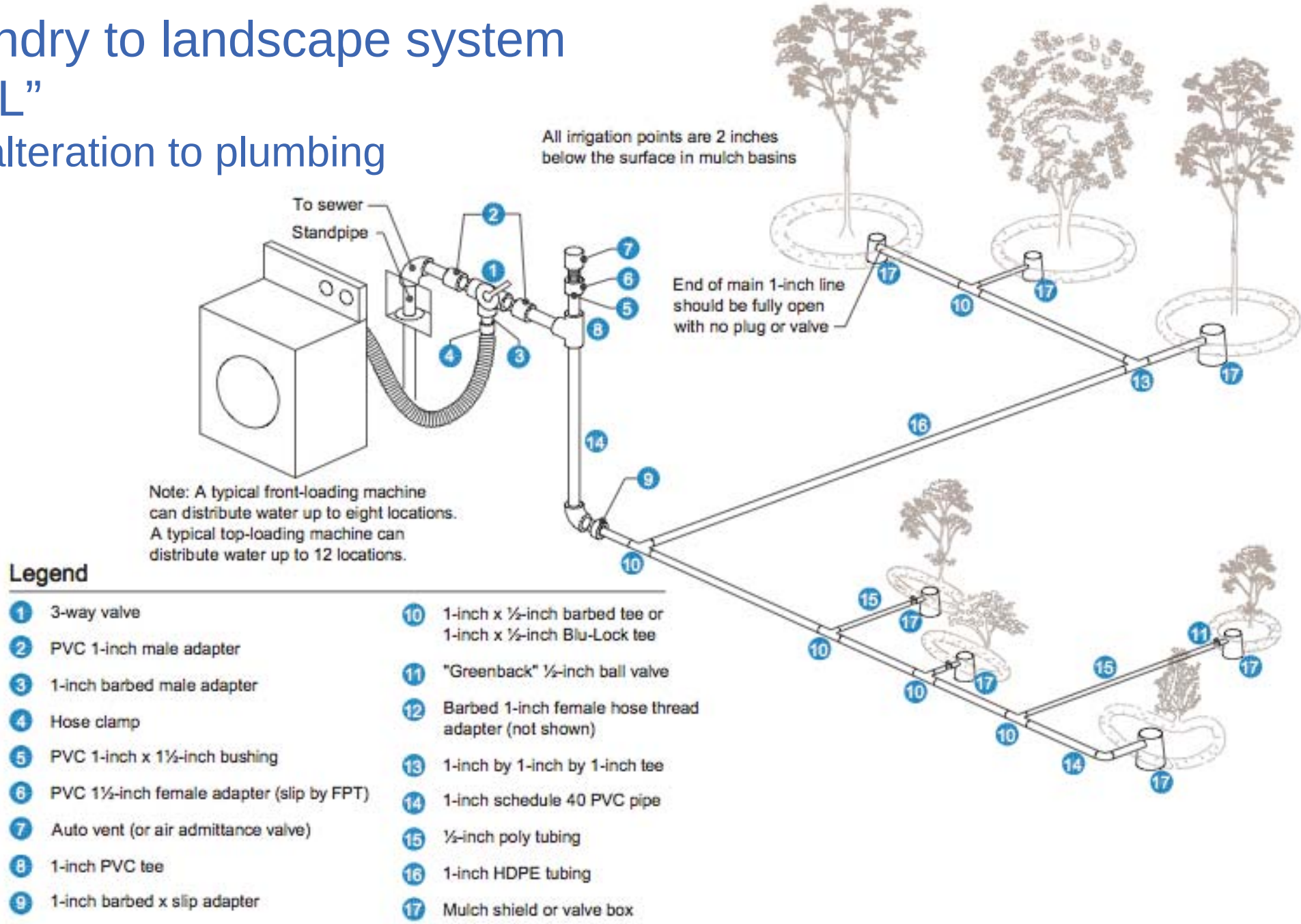
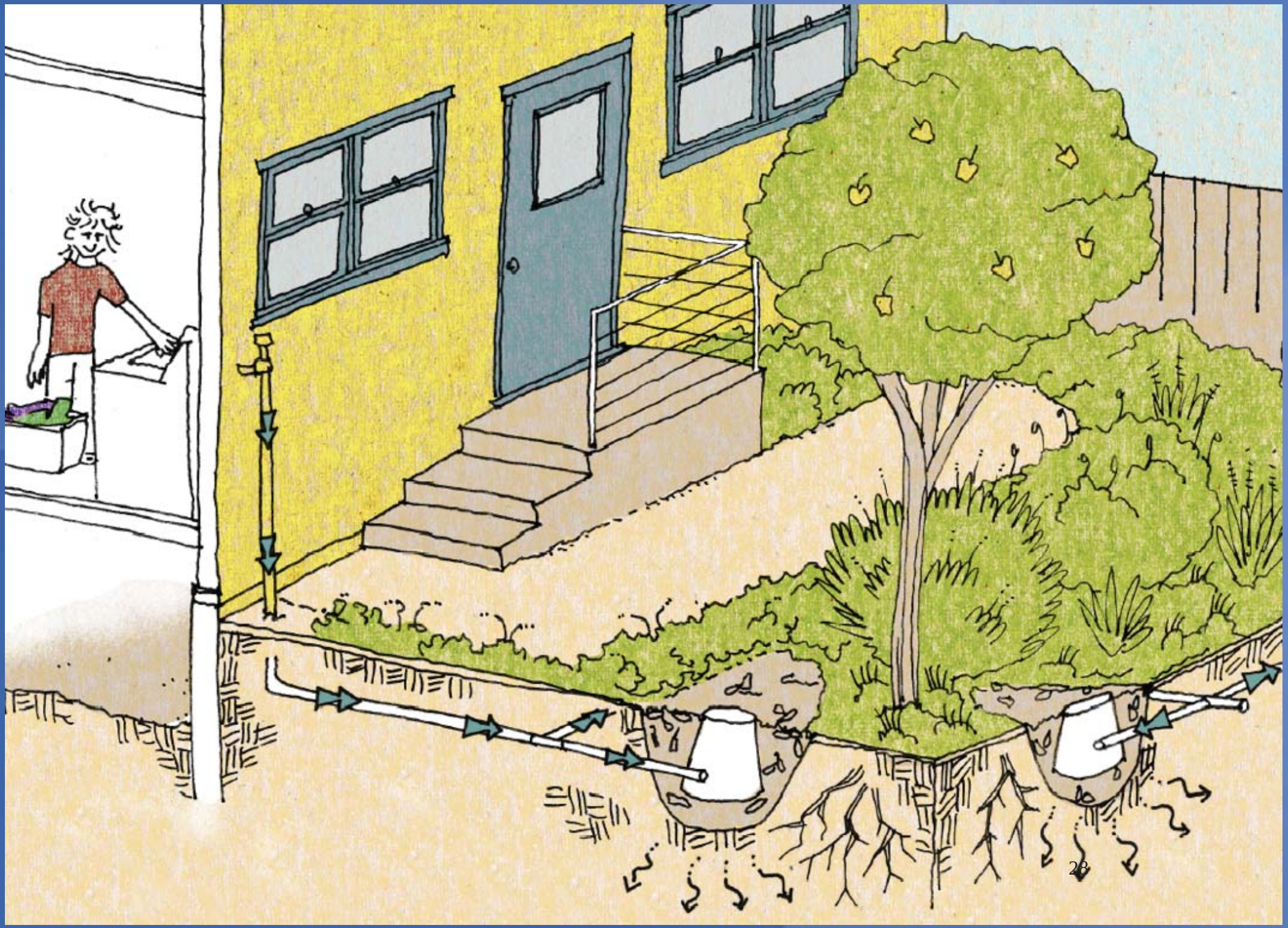


Figure 3. Laundry-to-landscape overview. Source: Clean Water Components.

laundry to landscape system

features:

* readily accessible diverter valve
* no alteration to plumbing
* uses 1” PVC to 1” HDPE mains: 1/2” branches to mulch basins
* can have multiple zones/ regulate amount to different areas
* easy to change as garden evolves
* end of one 1” main is left open so no back pressure



for tub/shower or sink greywater:

branched drain system

low tech / landscape direct
uses no tanks
no filters
no pumps

gravity carries the greywater to the garden

branched drain system

features:

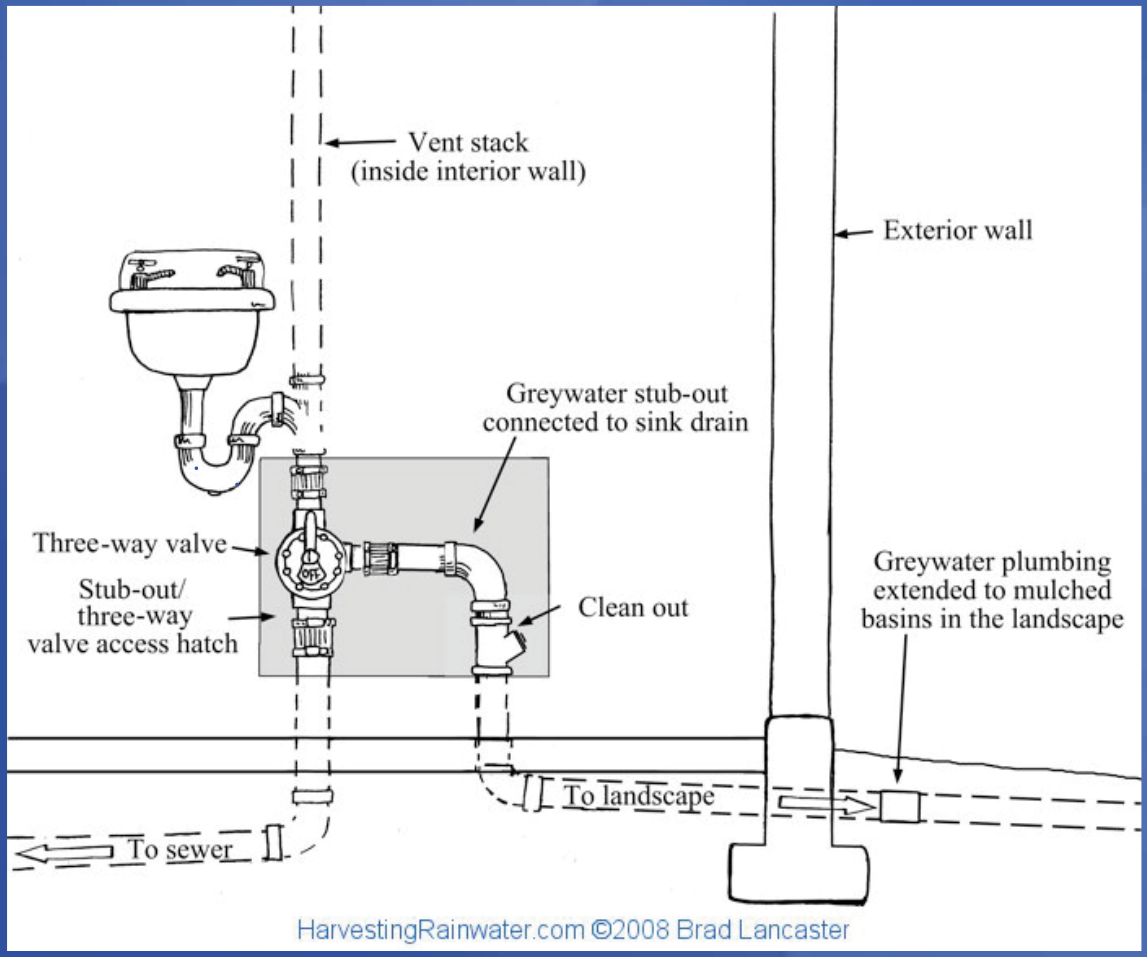
* permit required as plumbing is altered
* three way diverter valve is cut into drain line
* gravity flow through 2” to 1-1/2” ABS in garden
* piping installed with 1/4” per foot continuous slope to garden
* must be able to pass over/through perimeter foundation
* no limit to distance other than depth of trench

branched drain continued

* flow is distributed by double ell “flow splitters”
* discharges greywater inside mulch shield to disperse in mulch basin
* difficult to change once installed

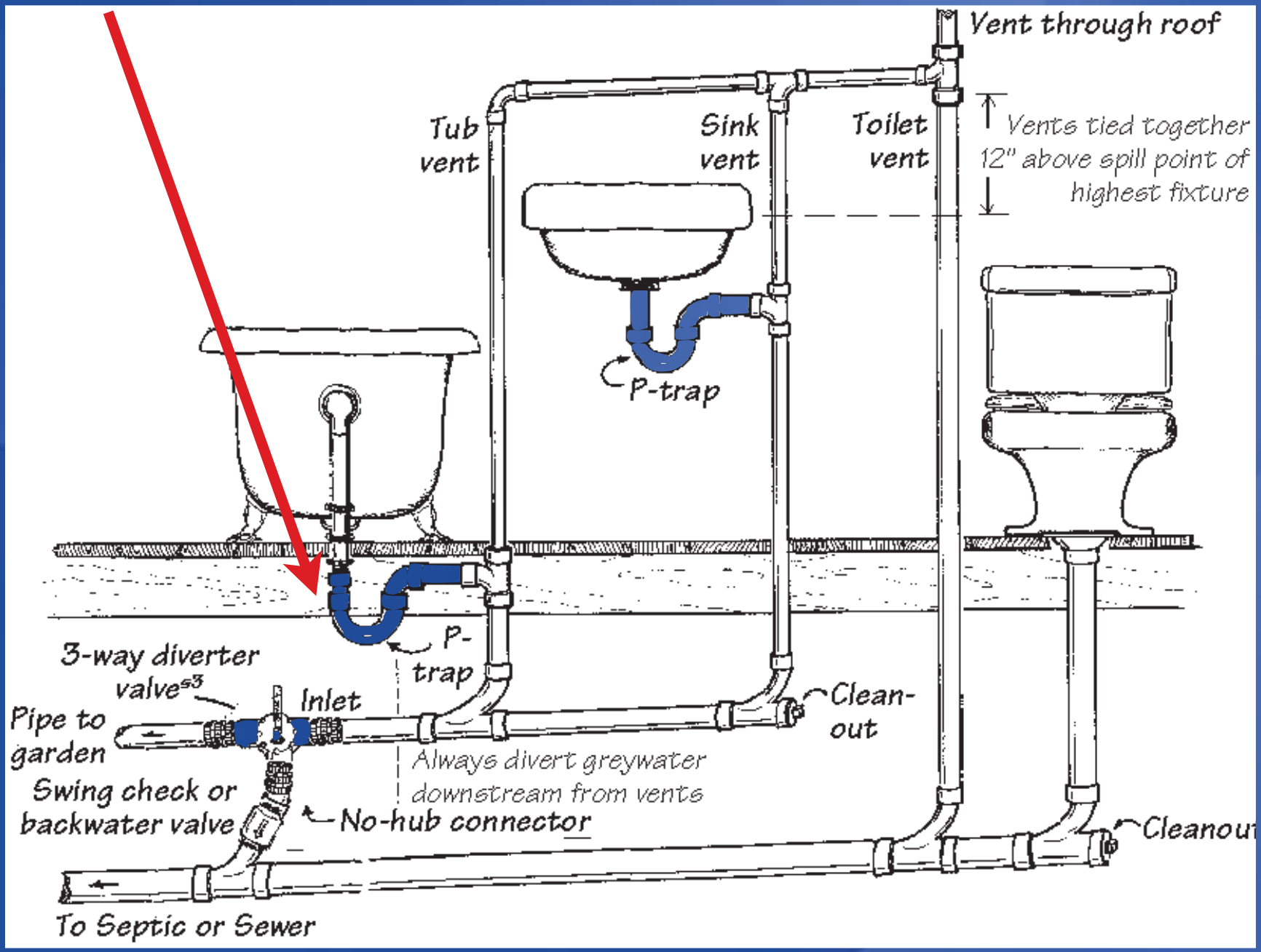
branched dain system

diverter valve required



sinks typically have traps above the floor
a three-way diverter valve can be cut into the drain pipe in the wall for easy access

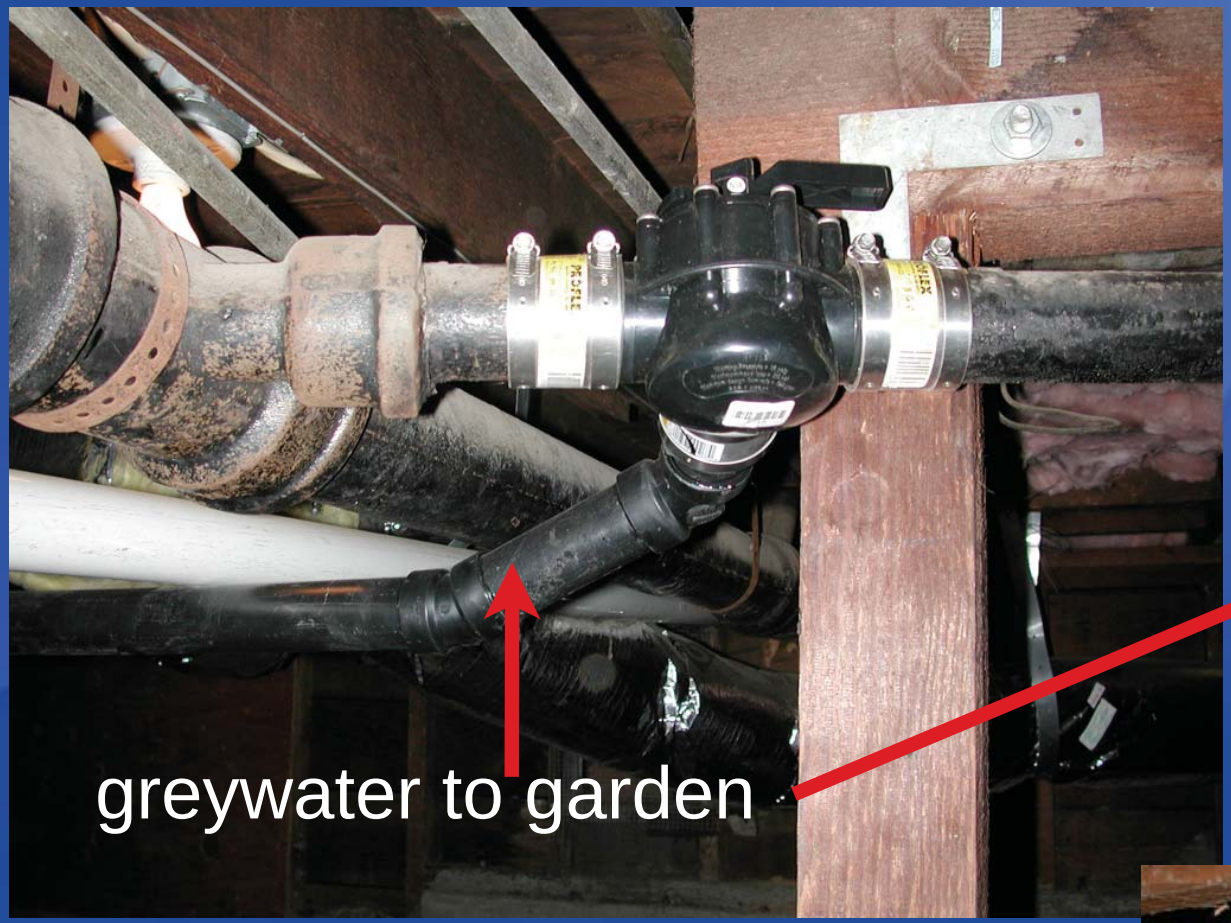
tub/shower traps are below the floor



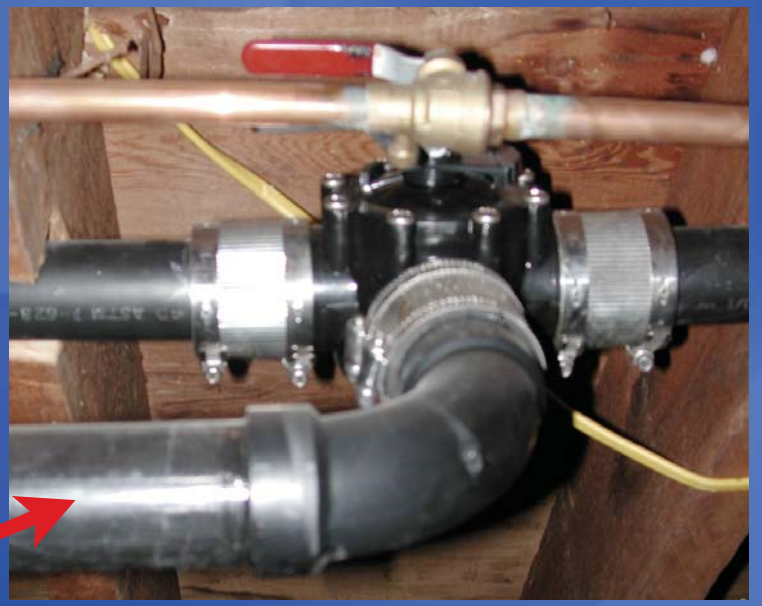
three way valve is installed before the greywater joins the blackwater

branched drain systems

cast iron shower drain



ABS drain



galvanized shower drain

drains for tubs and showers are underfloor in crawlspace/basement

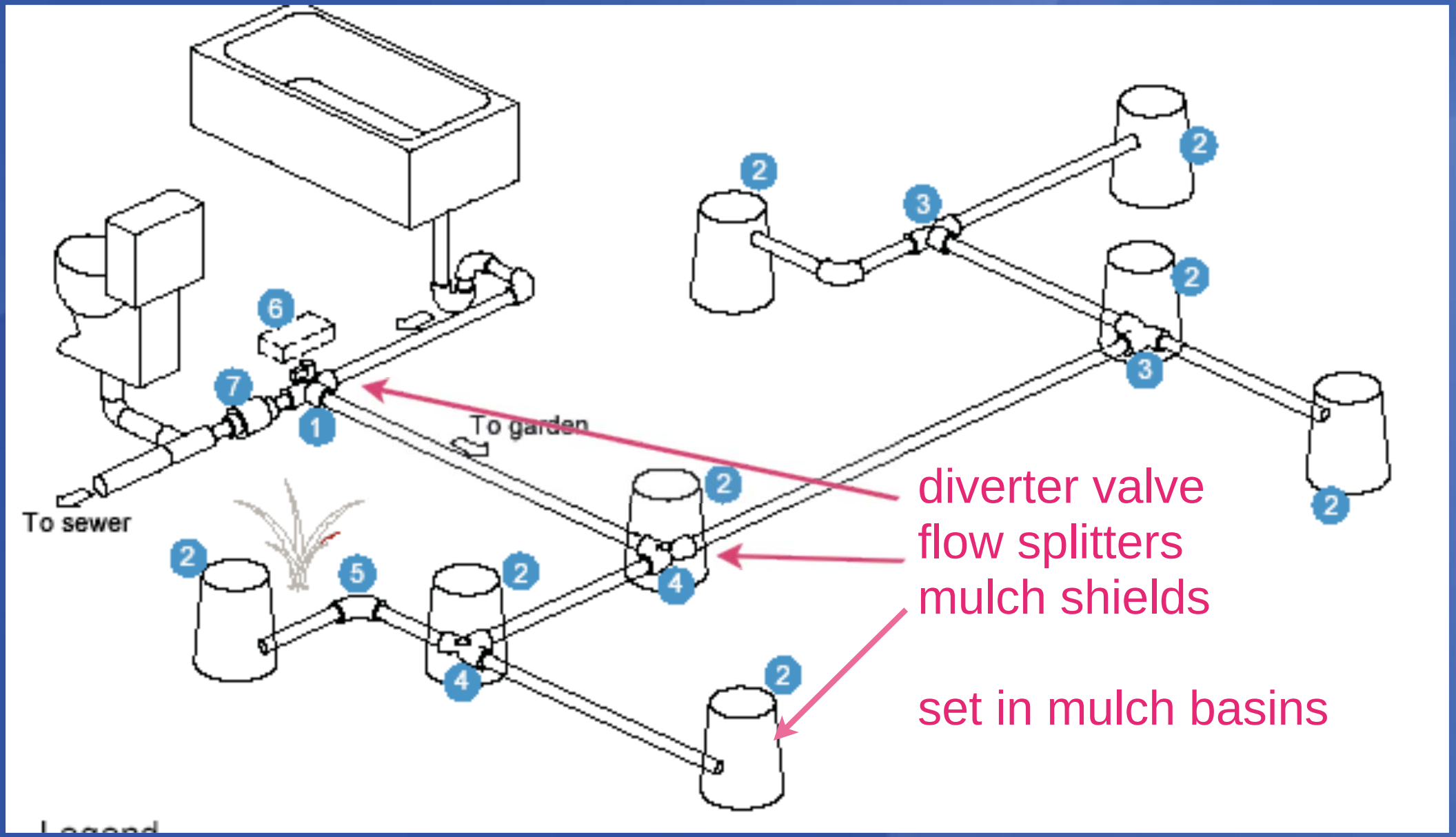
drain line is cut to install the three-way diverter valve therefore a permit is required

require electricity
must be labeled

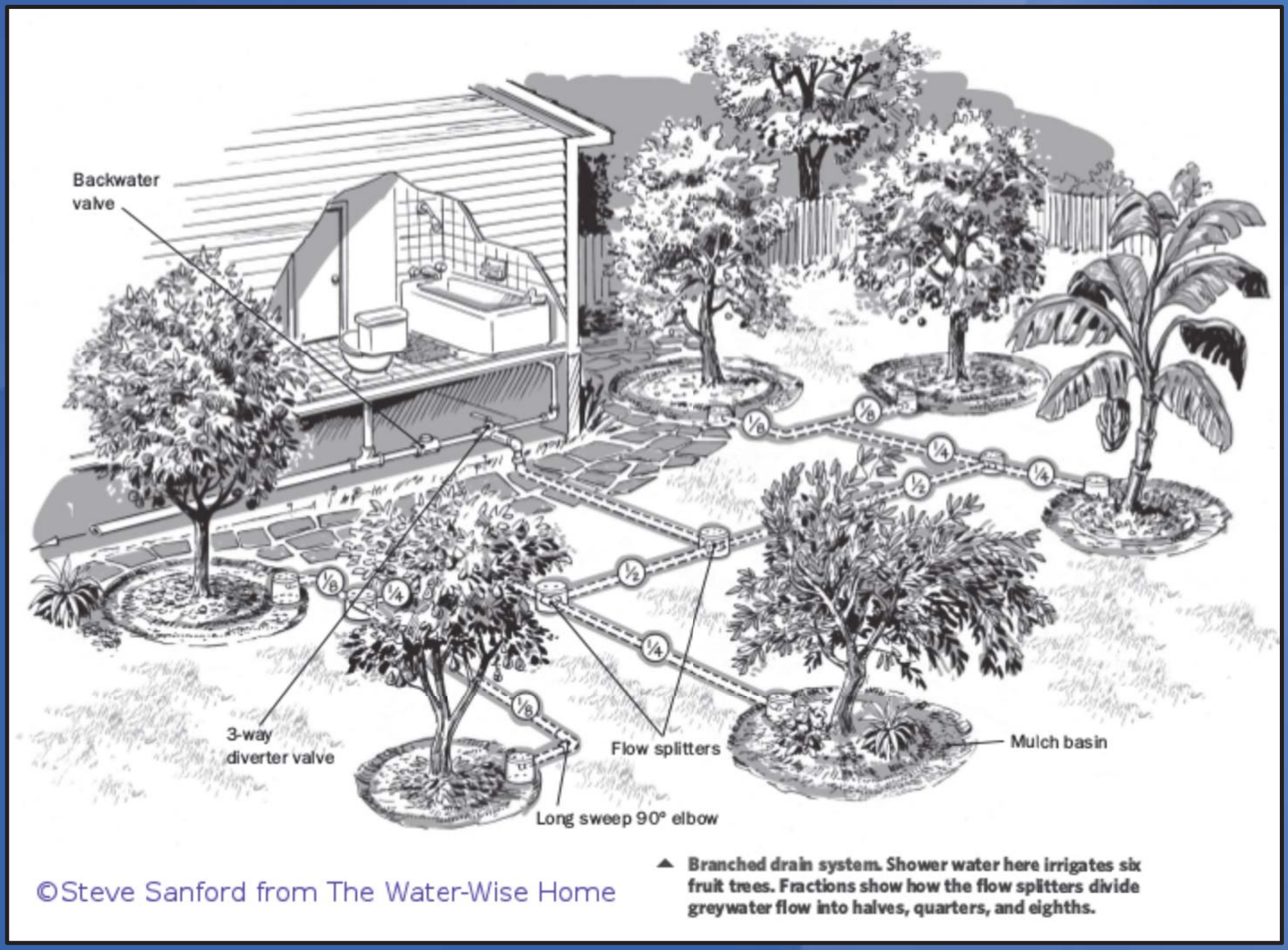
electronic “actuators”
for inaccessible valves:

switch is mounted
in more convenient location

branched drain components



“branched drain system” for tubs/showers/sinks



©Steve Sanford from The Water-Wise Home

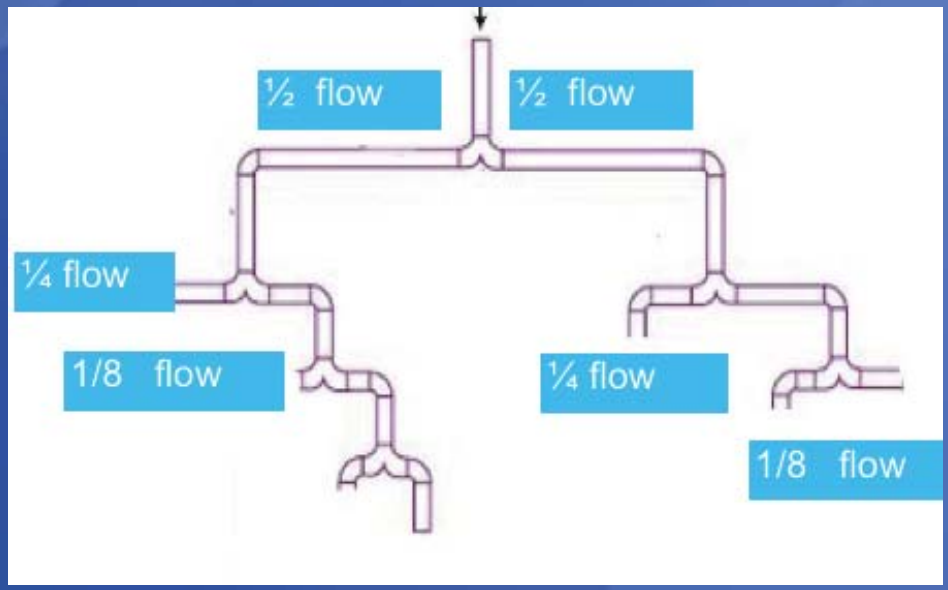
▲ **Branched drain system. Shower water here irrigates six fruit trees. Fractions show how the flow splitters divide greywater flow into halves, quarters, and eighths.**

cleanout plug drilled into fitting

“flow splitters” or “double ells”

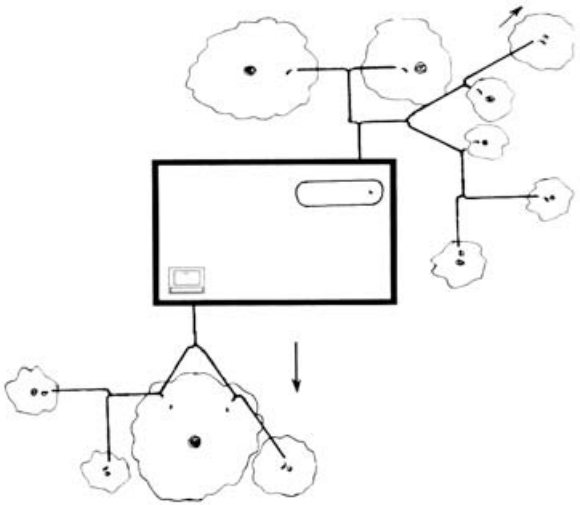
if perfectly level

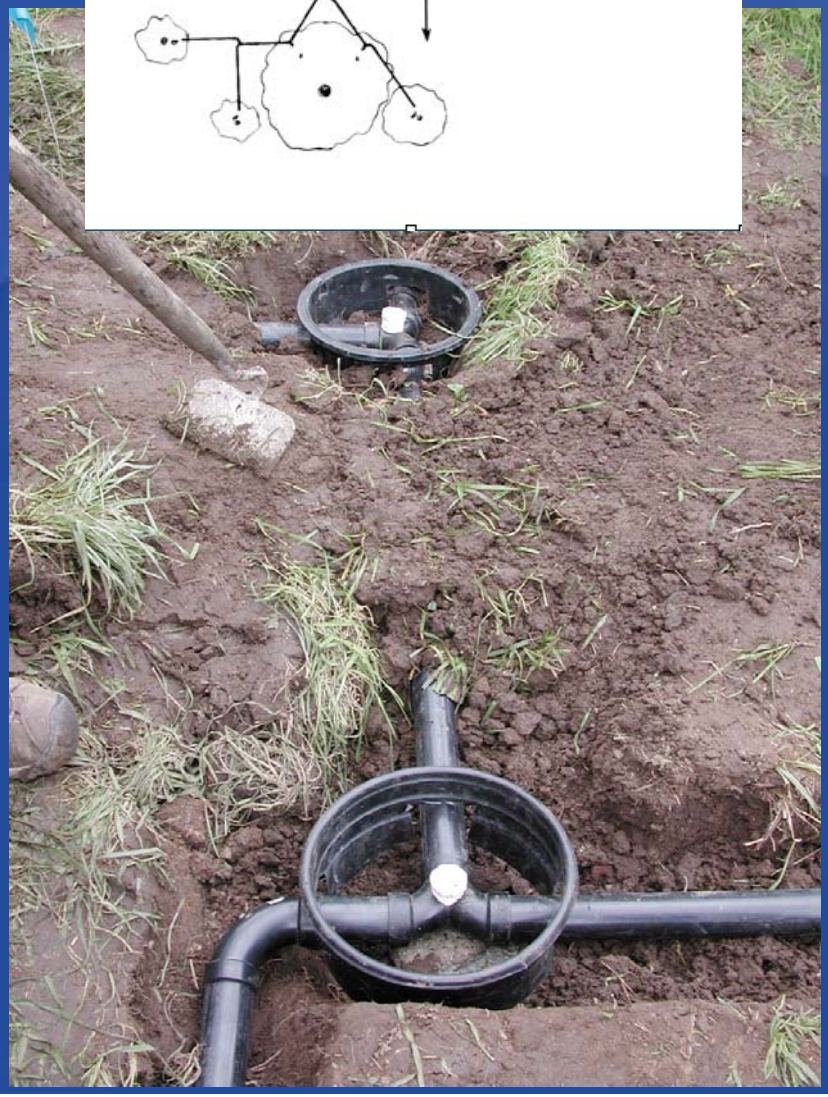
with 2’ run of straight pipe leading into them

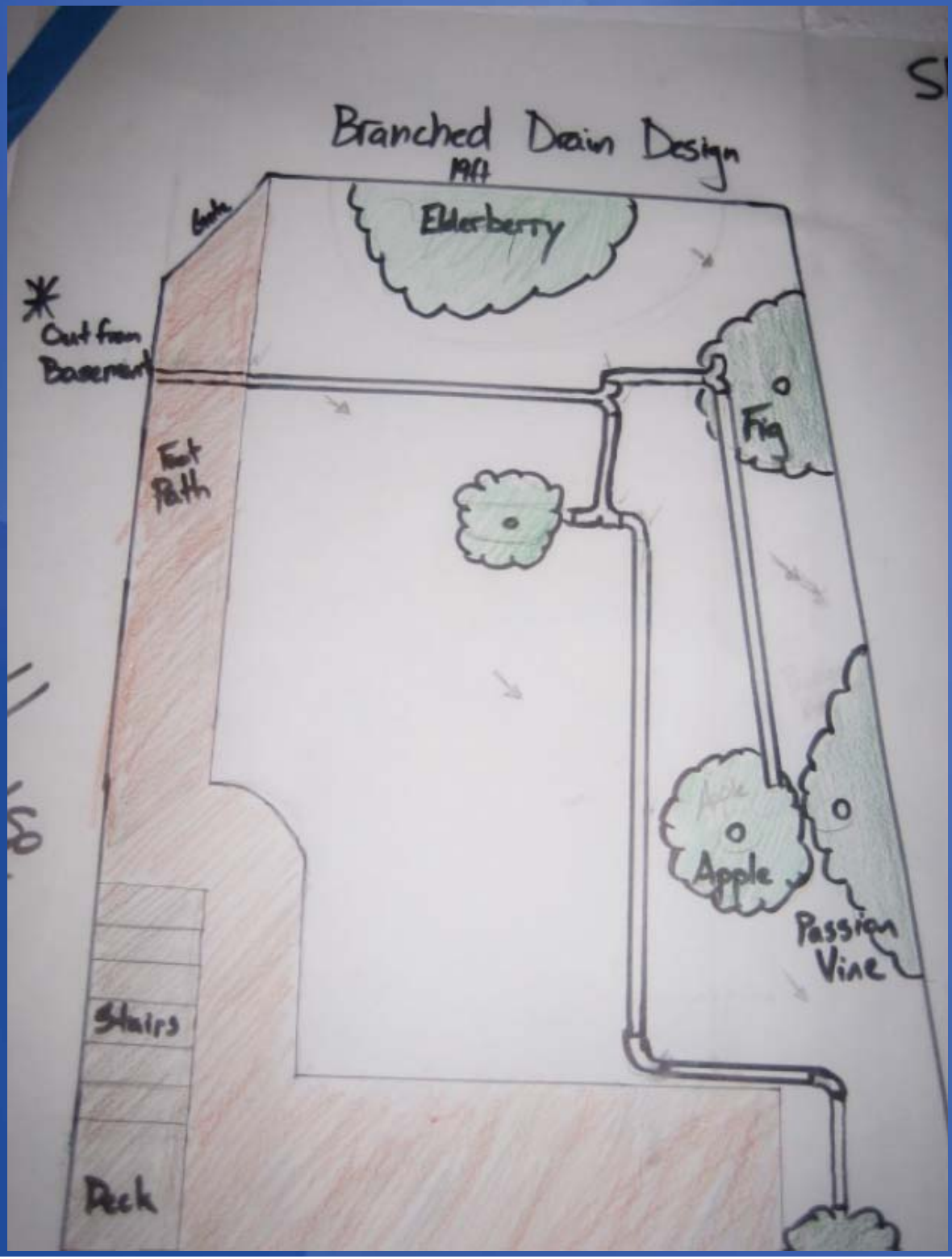


will split the flow evenly

FIGURE 9.1: FLOWS SPLIT VIA BRANCHED DRAIN
(PLAN VIEW)







mulch shield marks location of outlet
prevents root entry

mulch basin with mulch shield protecting outlet
mulch basin is at drip edge of tree

shower greywater branched drain in San Francisco:

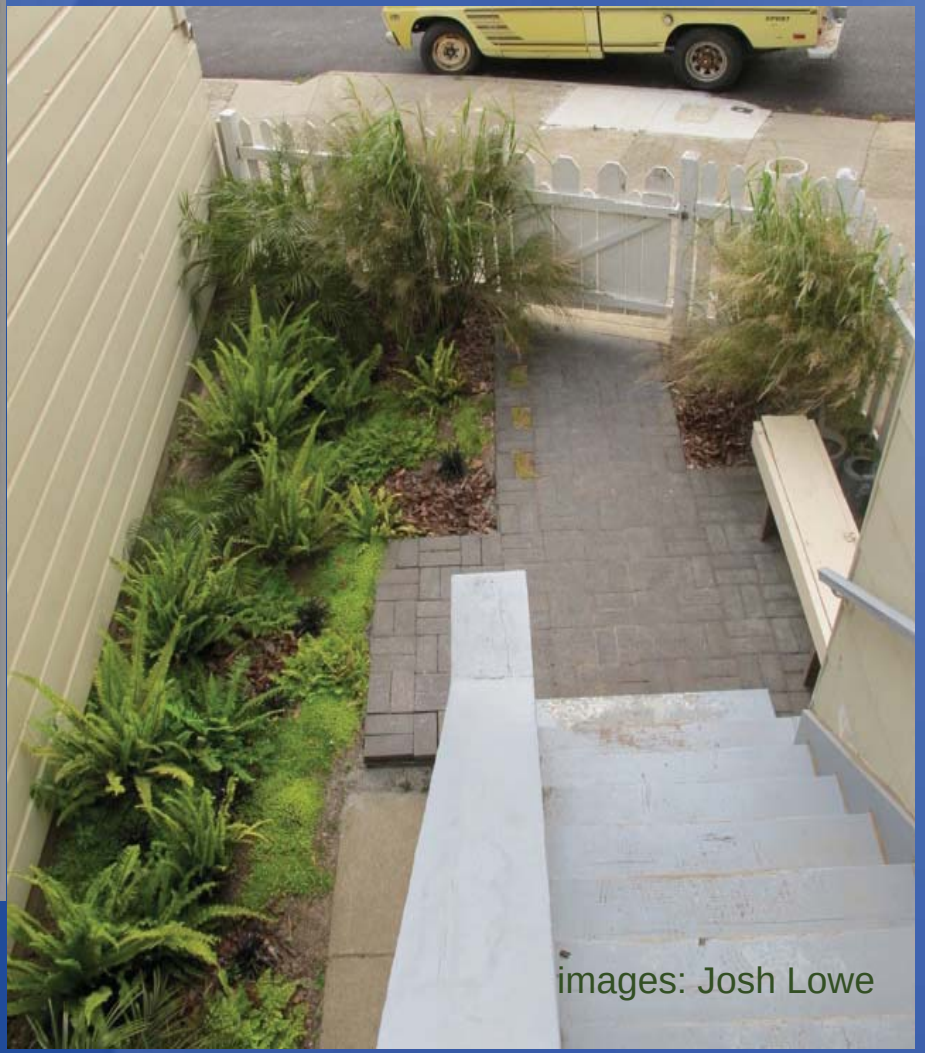
Setbacks from buildings and property lines

Greywater outlet is under a solid shield and flows into a mulch basin. Size of basin depends on soil type and amount of water.

Images: Josh Lowe

one year later

San Francisco project completed

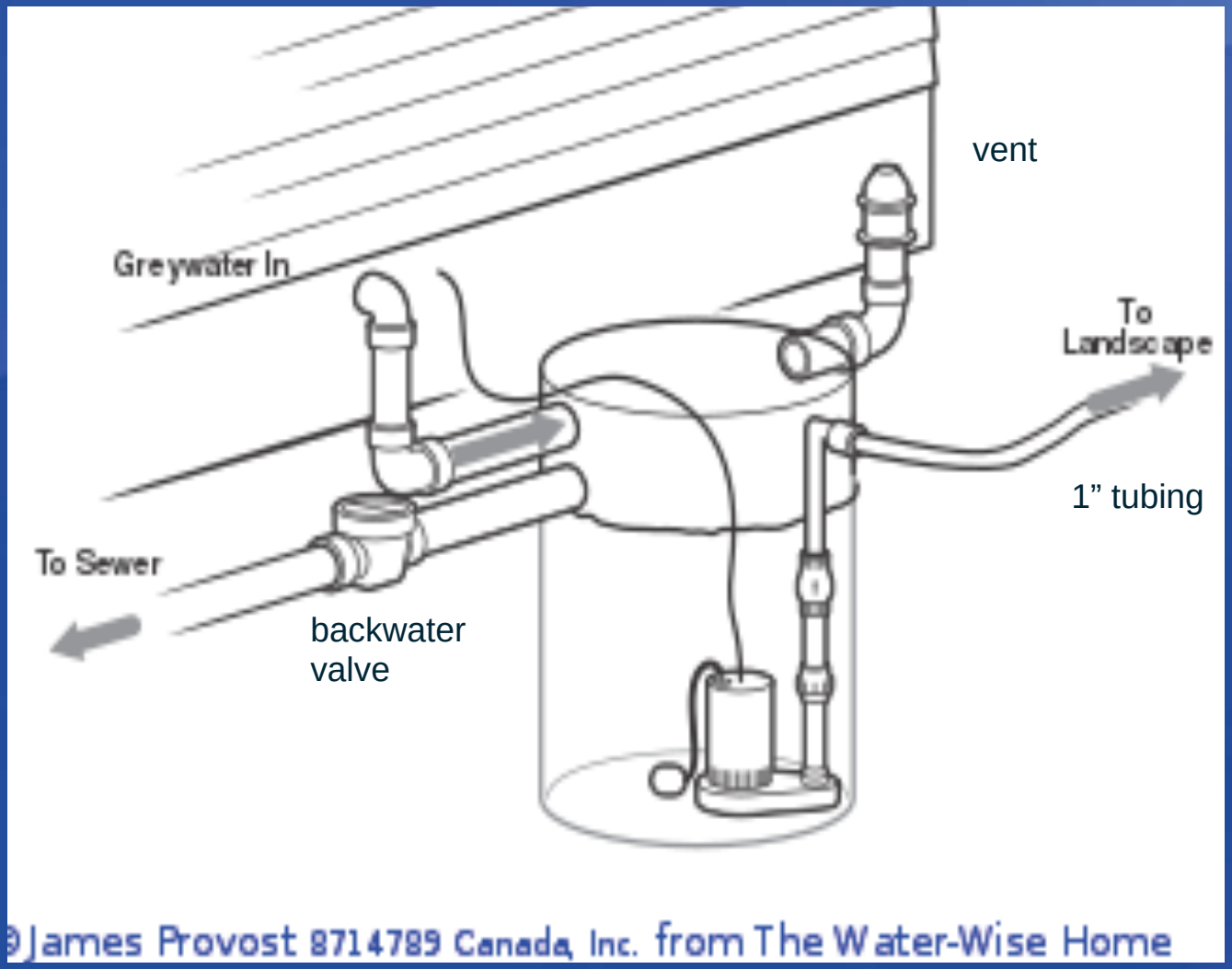


images: Josh Lowe

review: key points for branched drain

- gravity based system
- for bathtub, shower, sink
- need access to greywater drain pipes to install valve
- pipes continuously slope downwards (¼" per ft.)
- best for larger plants (trees, shrubs)
- uses 1-1/2” and 2” pipe

when area to be irrigated is uphill simple pumped system



- diverter valve directs greywater to surge tank
- float activated pump pushes unfiltered greywater to the landscape through 1" tubing and ½" outlets
- greywater is delivered to mulch basins
- overflow has backwater valve before joining sewer

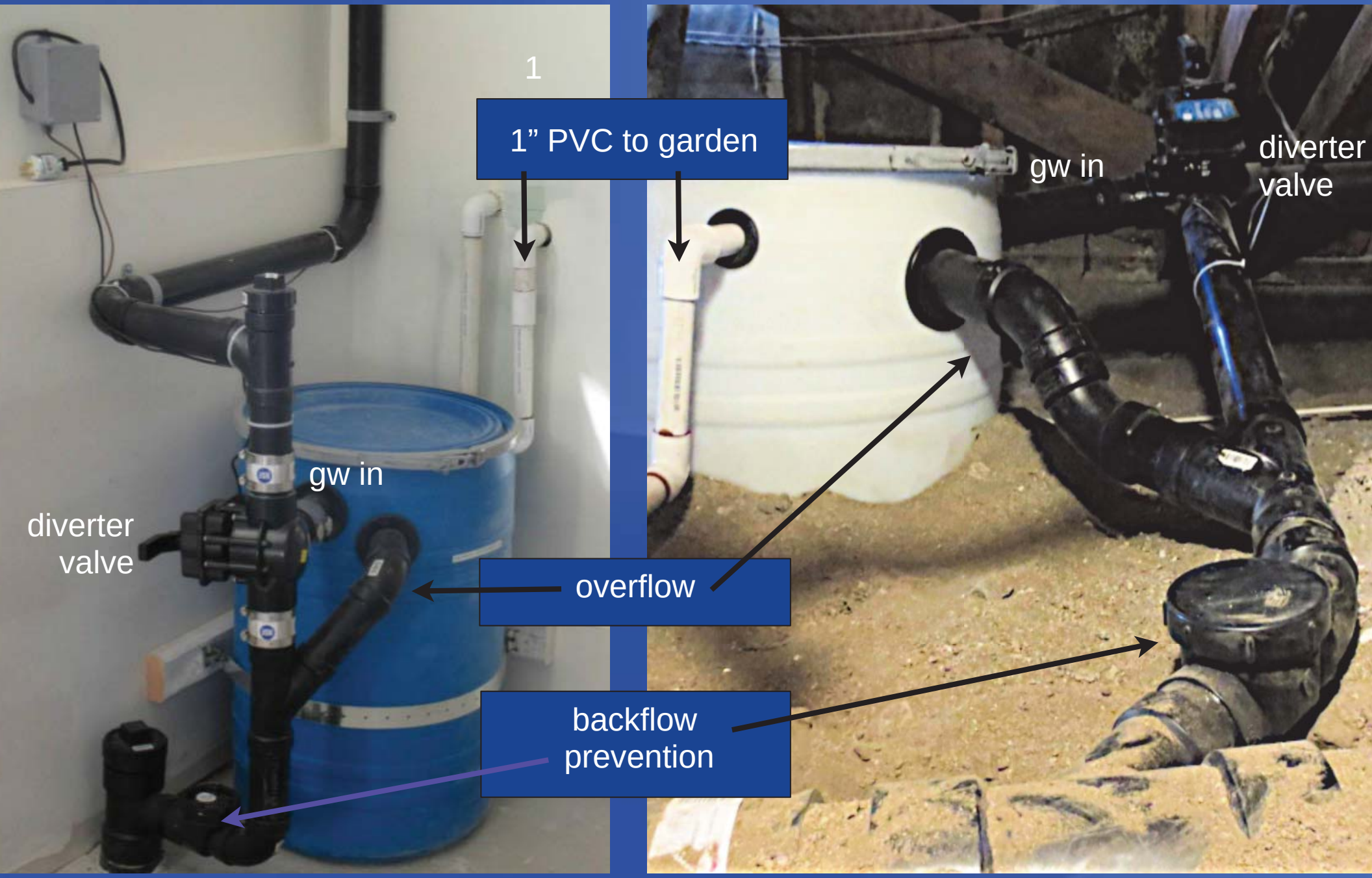


Photo: Leigh Jerrard

simple pumped systems

for low tech drip irrigation:

aqua2use system

matalla filters: clean 2x year

~surge tank with filters and pump

~overflow

~added strainer

~to IrriGRAY drip line

Aqua2use®
"The Answer for Greywater Reuse"

http://www.aqua2use.com

Note: Filtered GW requires special drip tubing and is not compatible with most standard drip systems.

IrriGRAY drip line

* low filtration (40 mesh or 400 micron)
* specifically designed for greywater
* each emitter has a built in filter
* pressure range 2 - 45 psi

* laid on soil surface
  if covered with
  2” of mulch

(other brands suitable for gw are also available)

high-tech:
drip irrigation with automatically cleaned filters and multiple irrigation zones

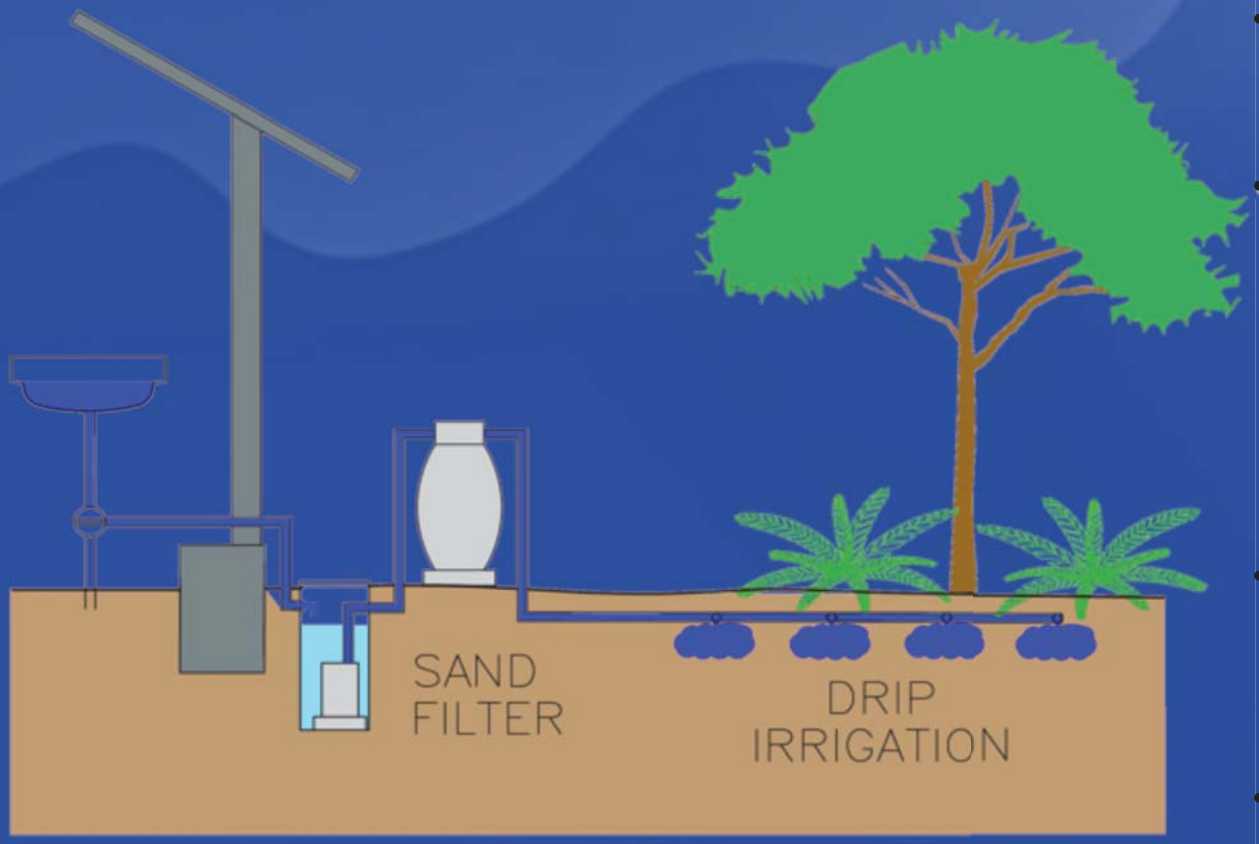
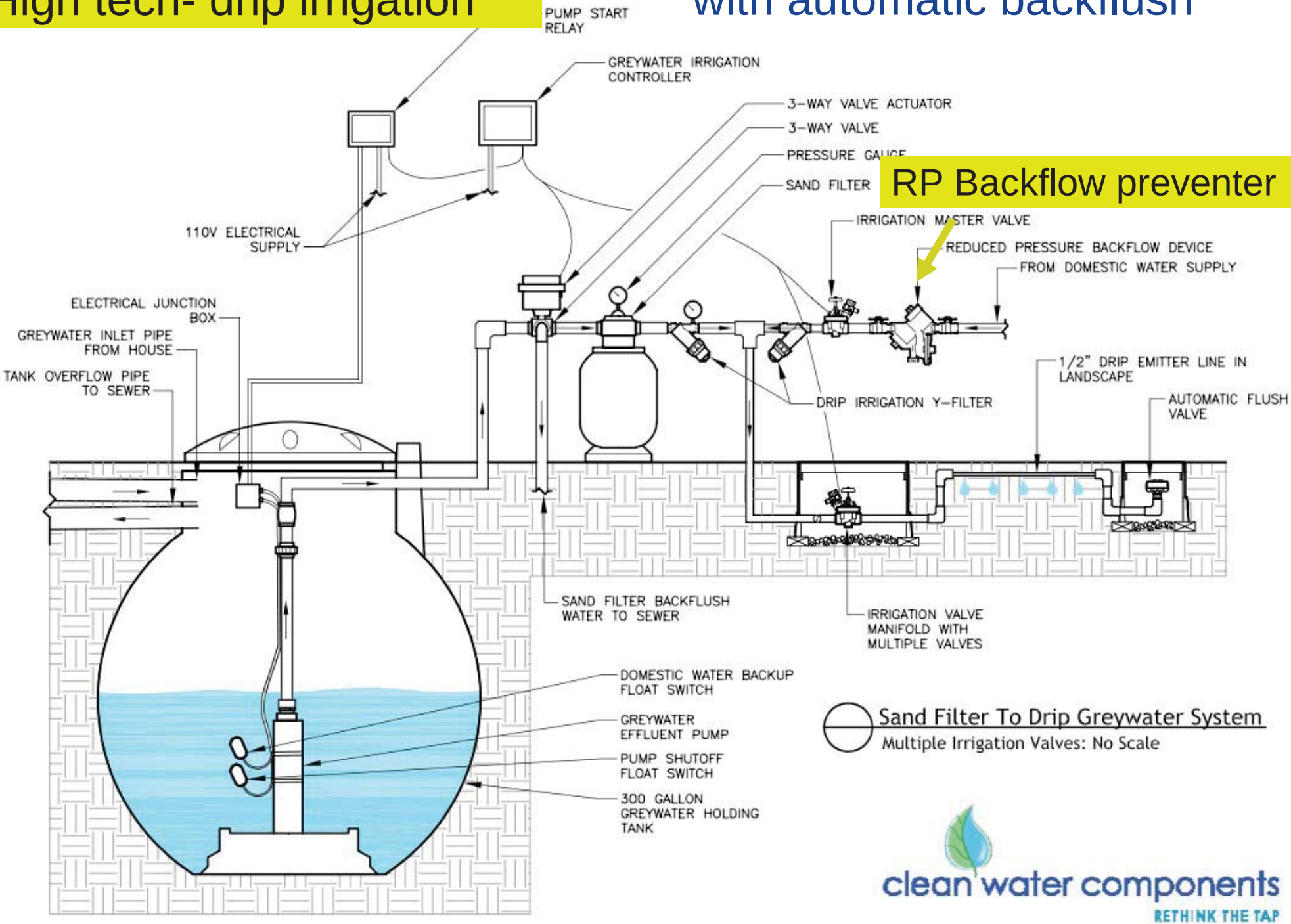


Image from Watersprout.org

- A sump basin collects greywater from the house
- A pump pushes water through a filter which removes particles. Filter is automatically flushed (this requires special “backflow prevention” and permits are much more complicated)
- Filtered greywater is distributed through drip irrigation tubing to plants
- Cost: $10,000 - $20,000

High tech- drip irrigation with automatic backflush



Sand Filter To Drip Greywater System

Multiple Irrigation Valves: No Scale

clean water components

RETHINK THE TAP

WaterSprout design | build | maintain

high end bay area systems

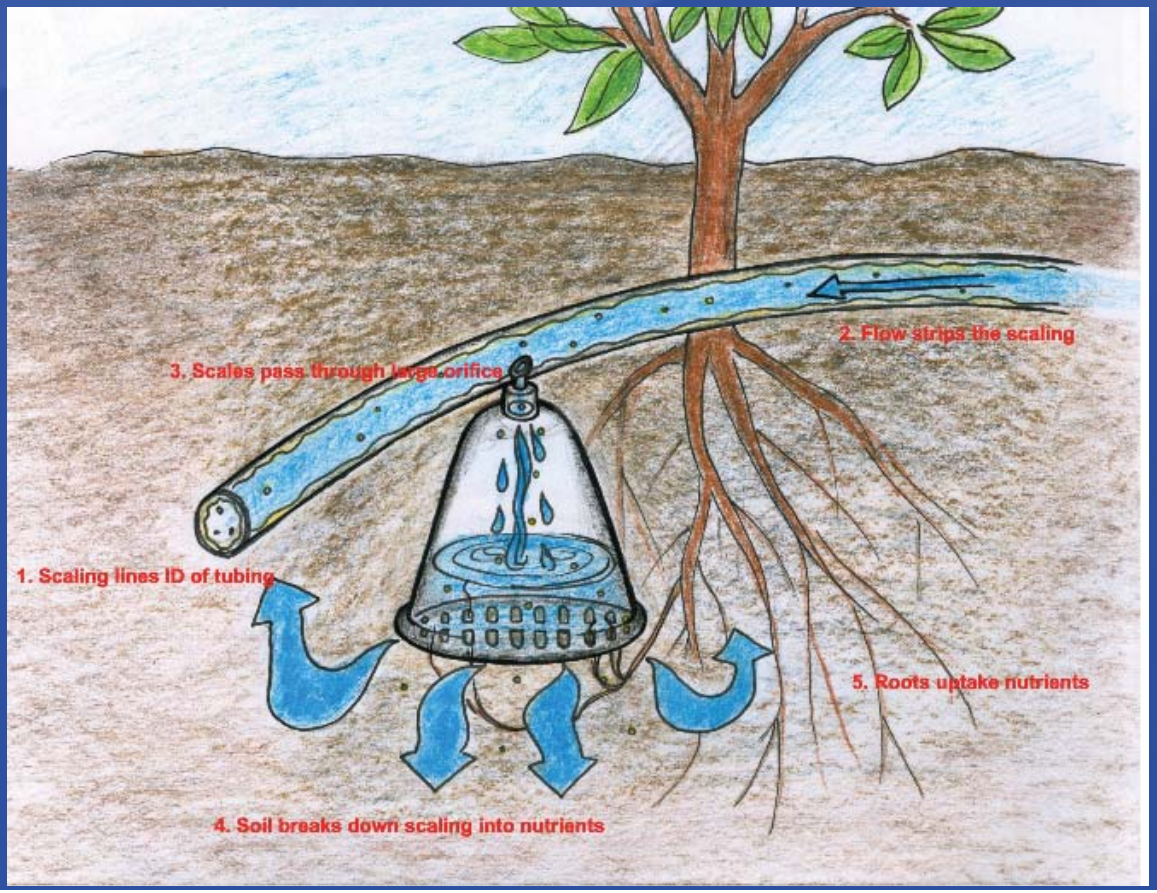
Images: Watersprout.org

REWATER SYSTEMS

The Future of Water. Since 1990

http://rewater.com

* underground drip system
  perfected for lawns
* sand filter, automatic backwash
* many kits available

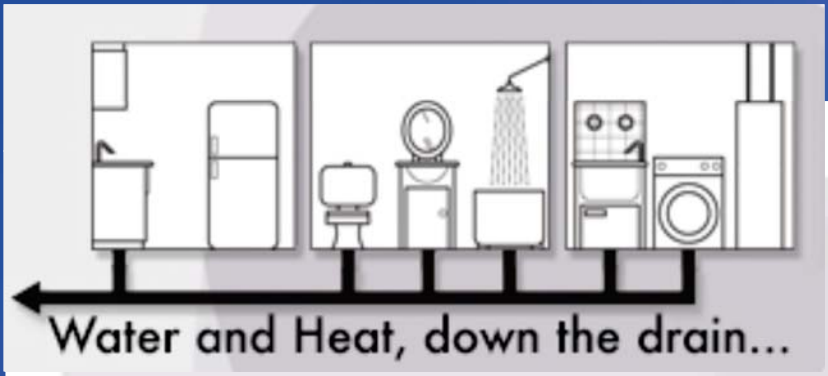


high tech: sand filter with automatic backflush drip irrigation in Palo Alto by Re-Water

image from Re Water website

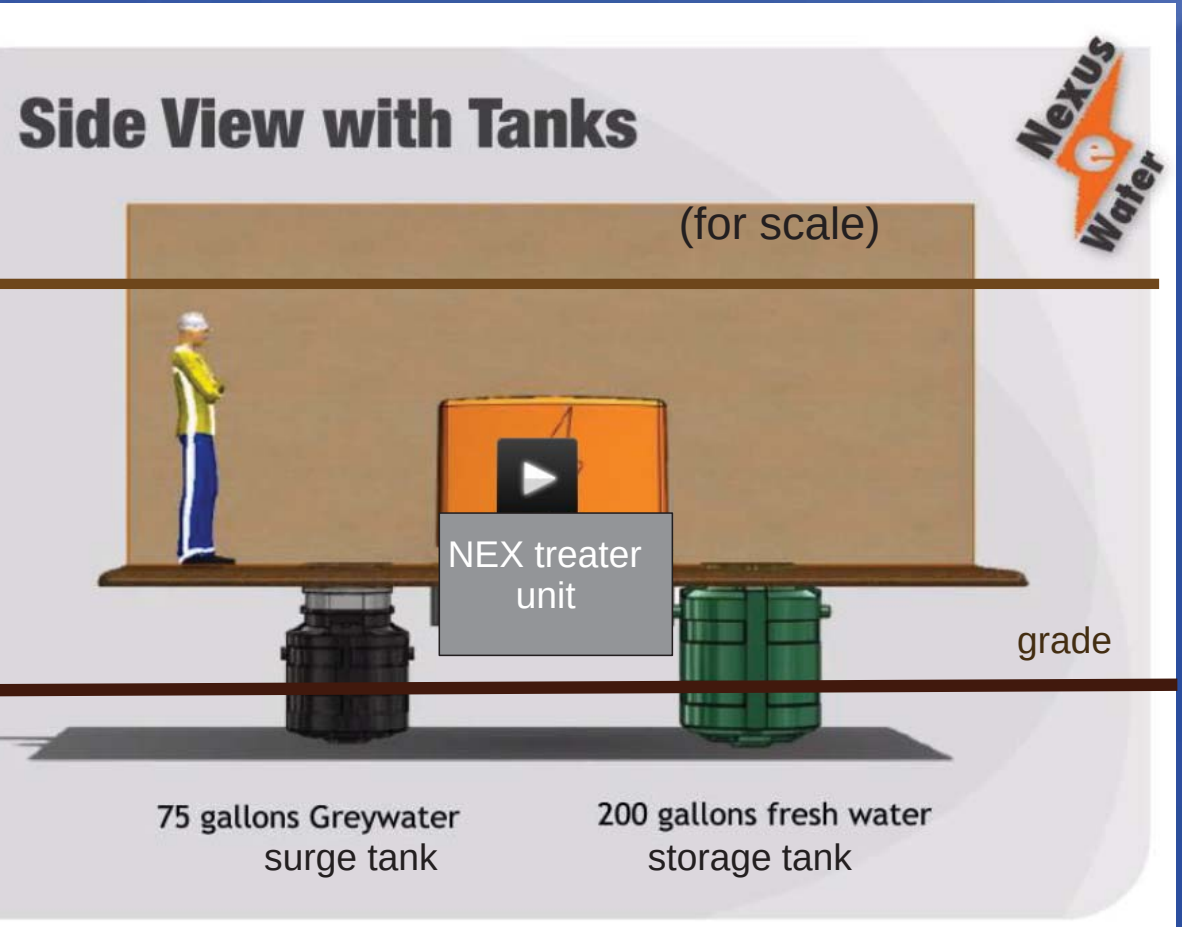
new whole house system

http://www.nexusewater.com



1. Grey water is collected
2. Warmth is extracted and sent to NEXheater
3. Water is treated in NEXtreater
4. Treated water is stored for lawn irrigation & toilet flushing

Nexus eWater



* 200 gallons gw daily
* treats tub/shower, hand sink, washing machine greywater to NSF 350 standard
* for toilet flushing or above ground irrigation
* easy to use and maintain
* requires no chemicals or biological culture

http://www.nexusewater.com

berkeley eco-house constructed wetland

constructed wetland

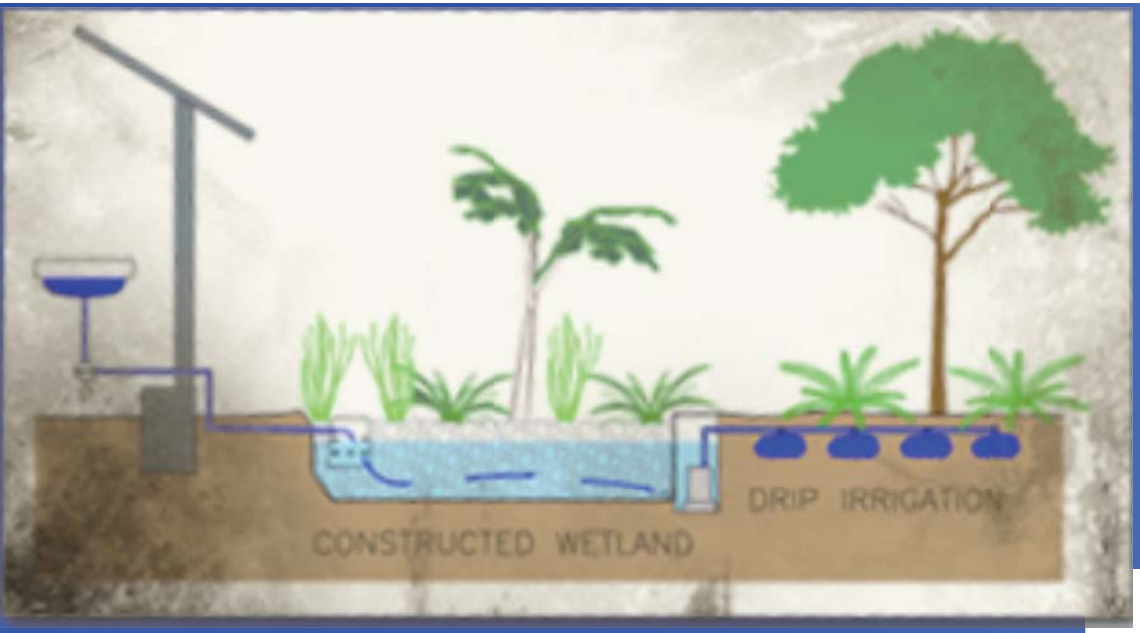
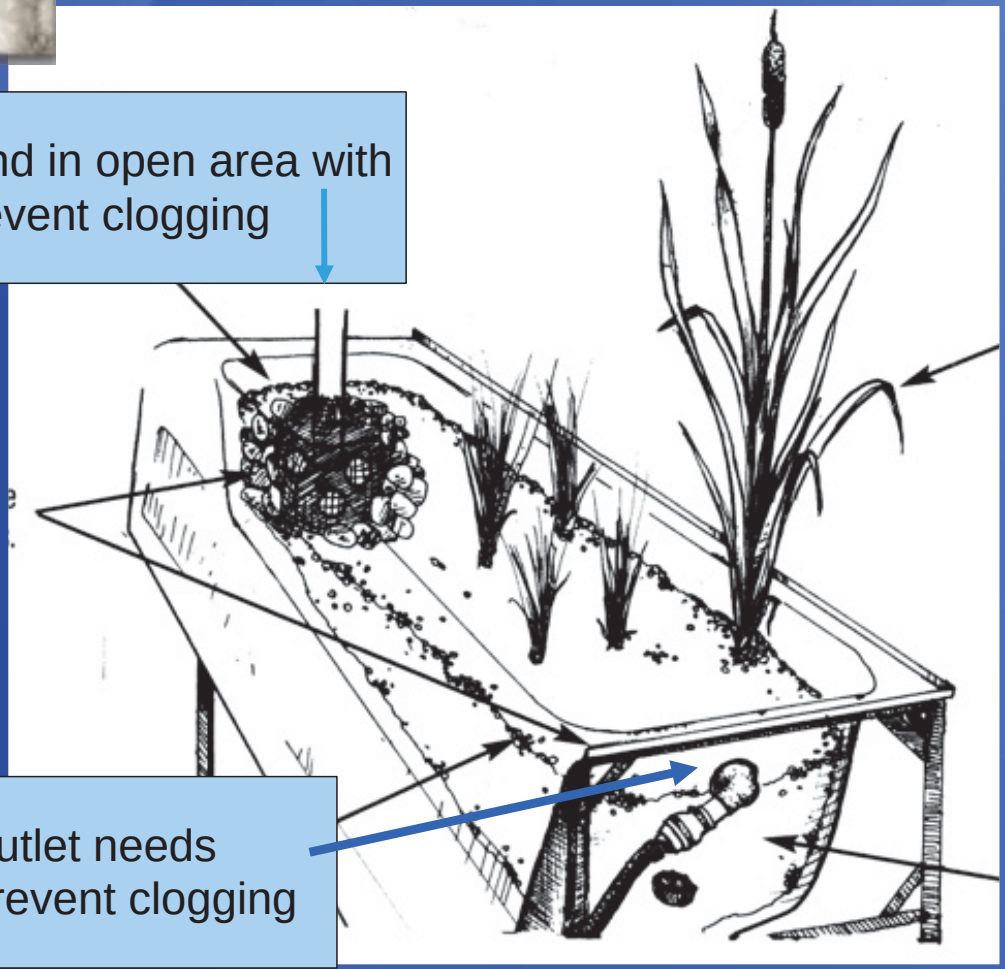


image by Watersprout

- greywater flows through substrate (usually gravel or rock)
- in a water tight container or pond liner
- overflow used elsewhere in garden

Greywater enters wetland in open area with large rocks to prevent clogging



Greywater outlet needs large rocks to prevent clogging

Image from Dam Nation

constructed wetland:

Pros

•way to dispose of excess greywater via transpiration

*can relieve overloaded septic systems

•wetland plants can create a lovely garden feature

•wetlands clean water, if sized properly the outflow is clear and odorless

Cons

*less water available for irrigation

•space required for wetland

•may clog over time

•generally requires engineering

•uses gravel and rock, which is mined (often from rivers)

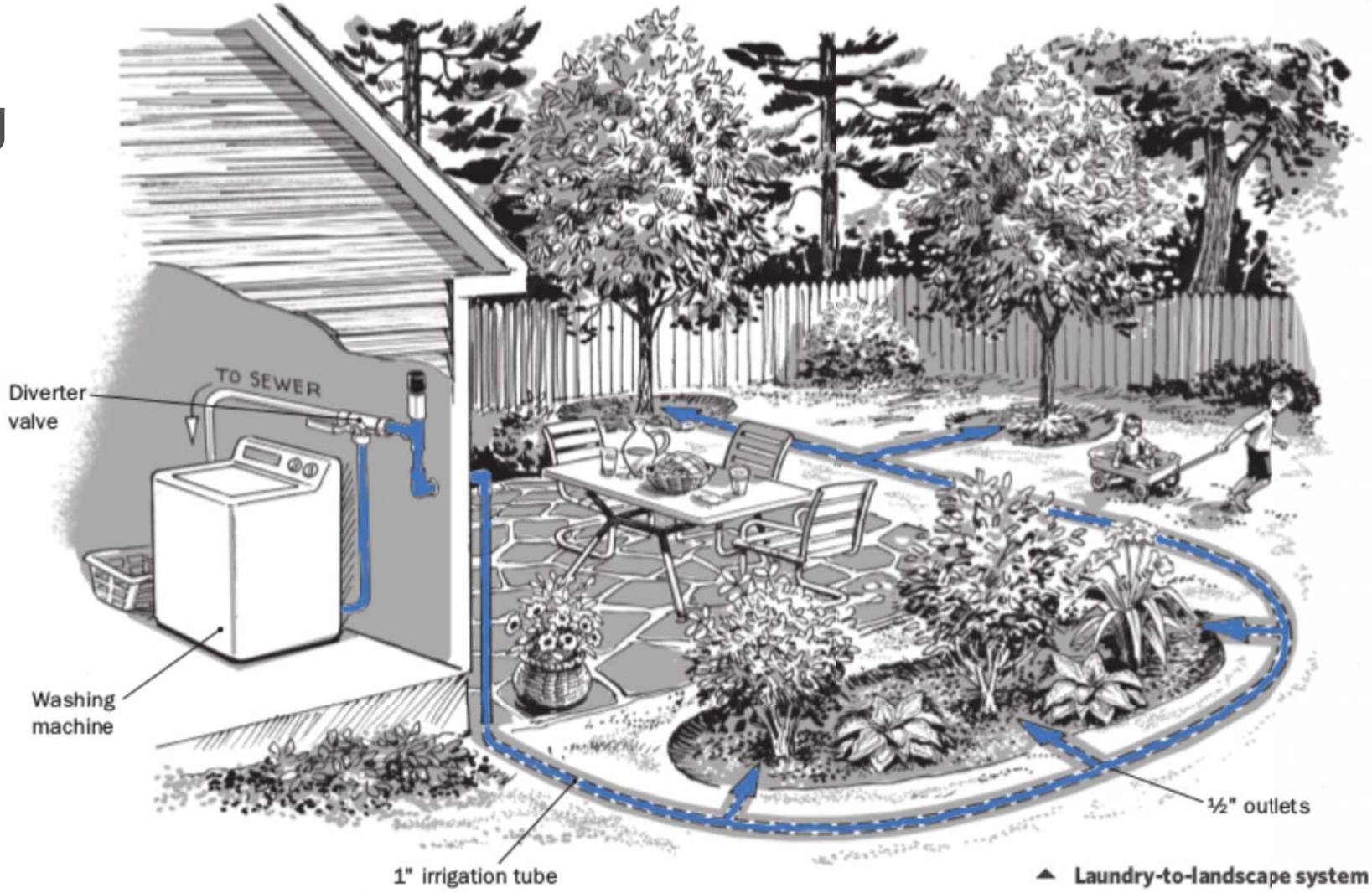
activity:

Greywater System Scenarios Practice

find a partner and decide which system would be best !

laundry-to-landscape system (L2L)

= a washing machine system
that doesn't alter the plumbing and doesn’t require a permit (if basic guidelines are followed).



▲ Laundry-to-landscape system

costs: $150-$250 parts, $700-$2,500 professional installation

laundry to landscape system "L2L"

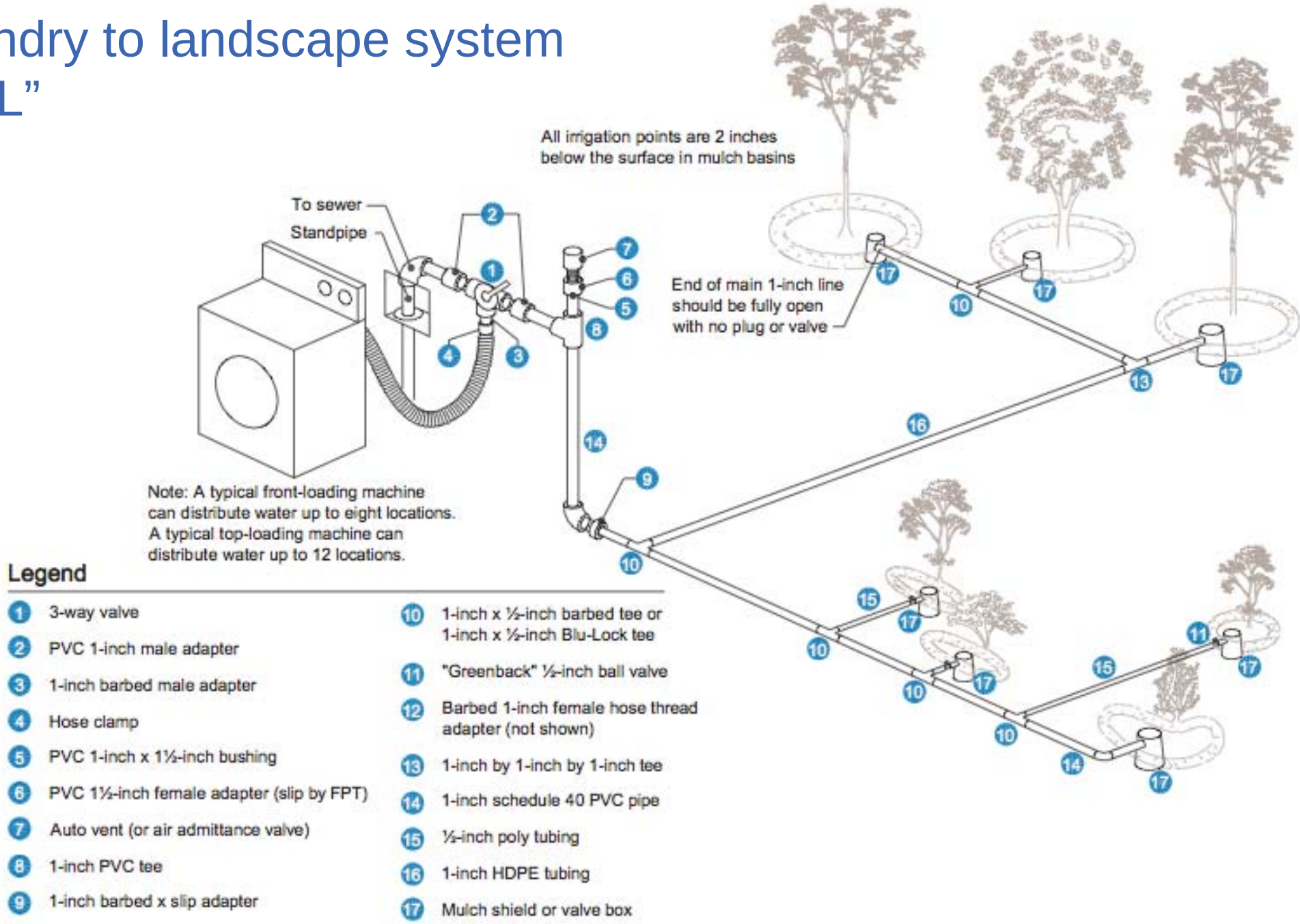


Figure 3. Laundry-to-landscape overview. Source: Clean Water Components.

laundry-to-landscape system

top loading machine: 35-50 gals
can distribute water up to 20 places

front loading: 12-25 gals
can distribute water up to 8 places

(depends on machine and landscape)

inside the laundry room...

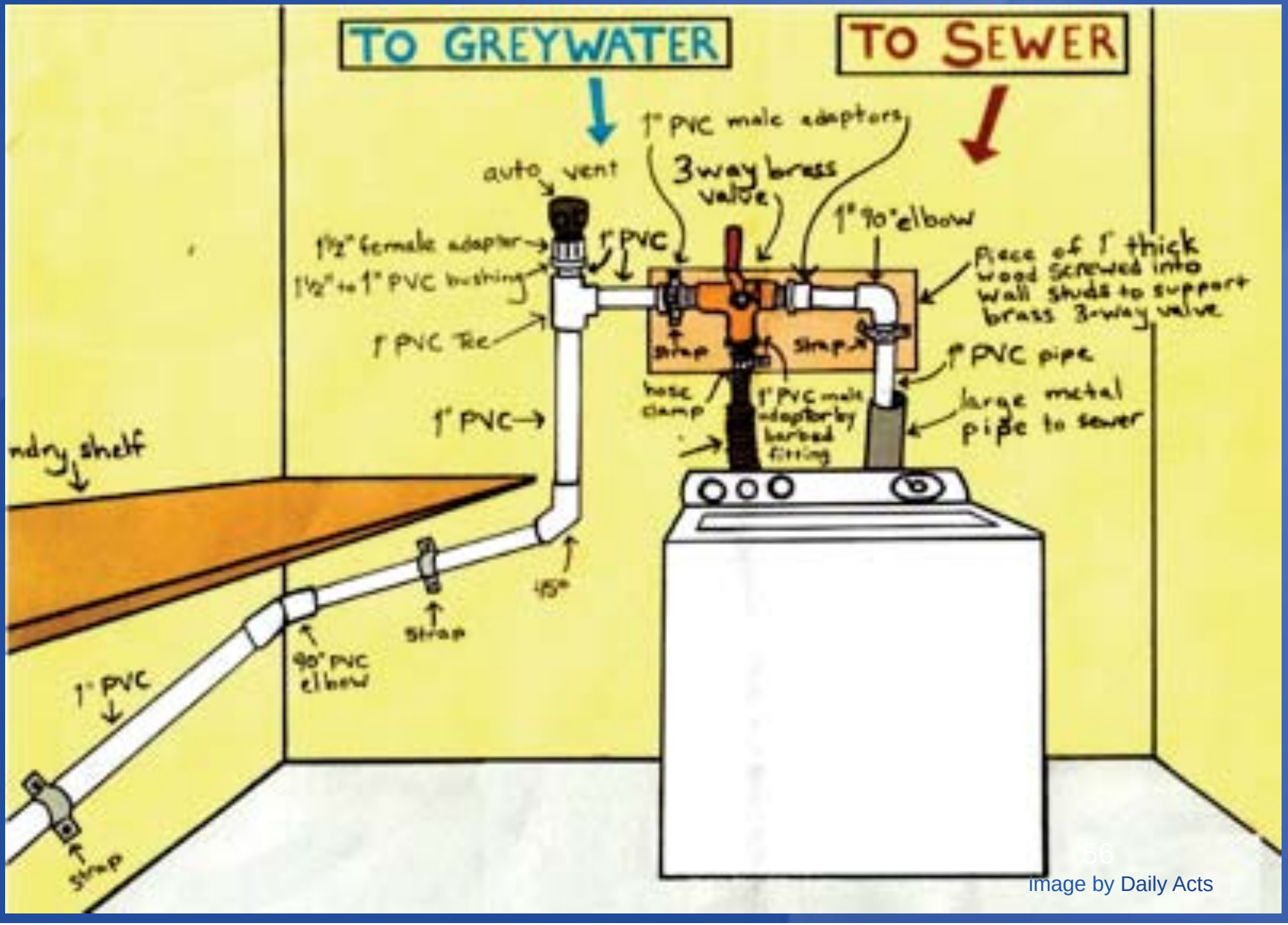


image by Daily Acts

washing machine box

laundry sink

standpipe

1” three-way valve:

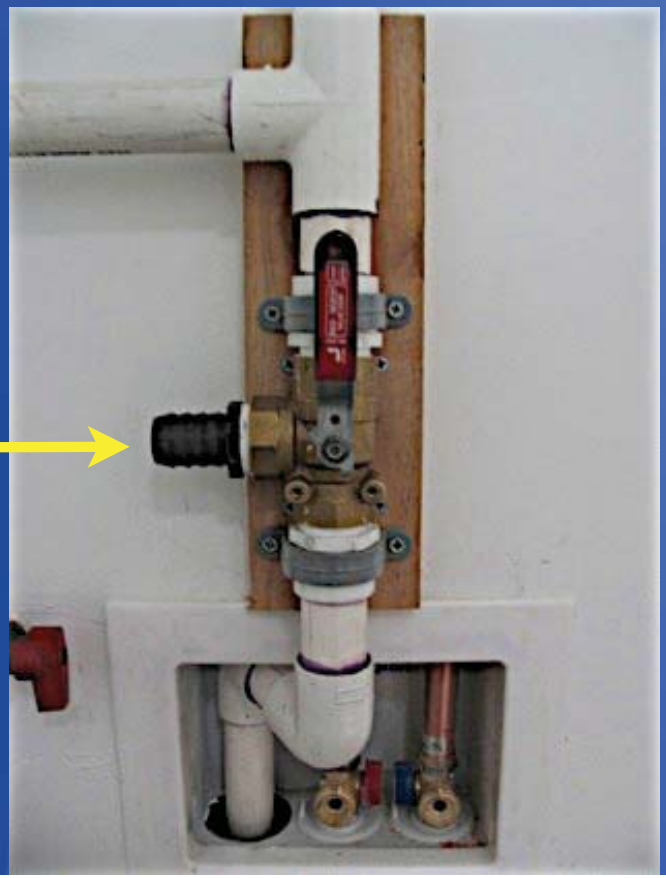
placed higher than top of machine

directs greywater to sewer or to garden

3-way valve

may be vertical
or horizontal

washer hose always
connects to middle port

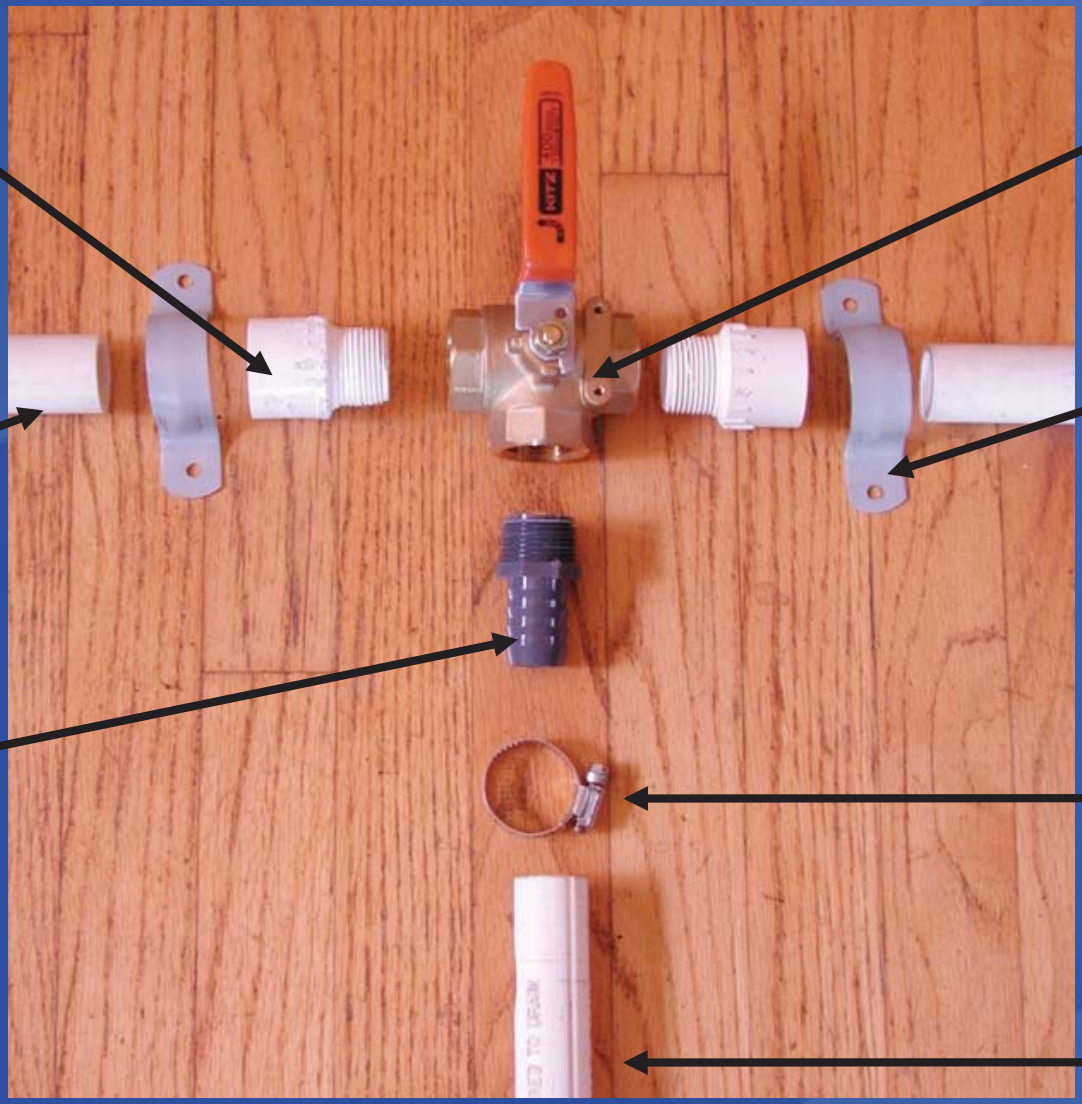


making the valve accessible~~

even in a tight closet with
stacking washer/dryer!

Photo by: Greywater Action

assembling the 3-way valve



1”- PVC male adapter

1”- Schedule 40 PVC pipe

1”- PVC male adapter: NPT x 3/4” or 1” barb

1”- Brass 3-way valve

2-hole strap

Hose clamp

Washer hose (from machine)

teflon tape on threads

teflon tape may help prevent leaks

wrap tape CLOCKWISE around threads 3 to 4 times

careful not to "cross-thread" when screwing PVC threads into metal 3-way valve

tighten with appropriate tool

tips for connecting washer hose

- Select the right size barbed adaptor to fit the machine discharge hose (¾” or 1”)

- If it’s difficult to slip hose over barb, heat hose with hair dryer or hot water to expand it

Photo by:
Greywater Action

- Secure with hose clamp

If unable to securely fasten hose to barbs:

try using vinyl tubing to “bridge” from hose to barbs

fasten with clamp over barbs and over hose

Photos by: Greywater Action

strap indoor assembly

- use 2-hole straps
- 1-1/4” electrical straps (plastic) for over 1” PVC fittings
- 1” electrical straps over 1” PVC pipe
- add wood blocking if necessary
- strap so valve is secure

valve label explaining how to use it

handle position
is easiest way
to indicate direction of flow

also post instructions
that bleach, diaper water,
or washwater with chemicals
must go to sewer

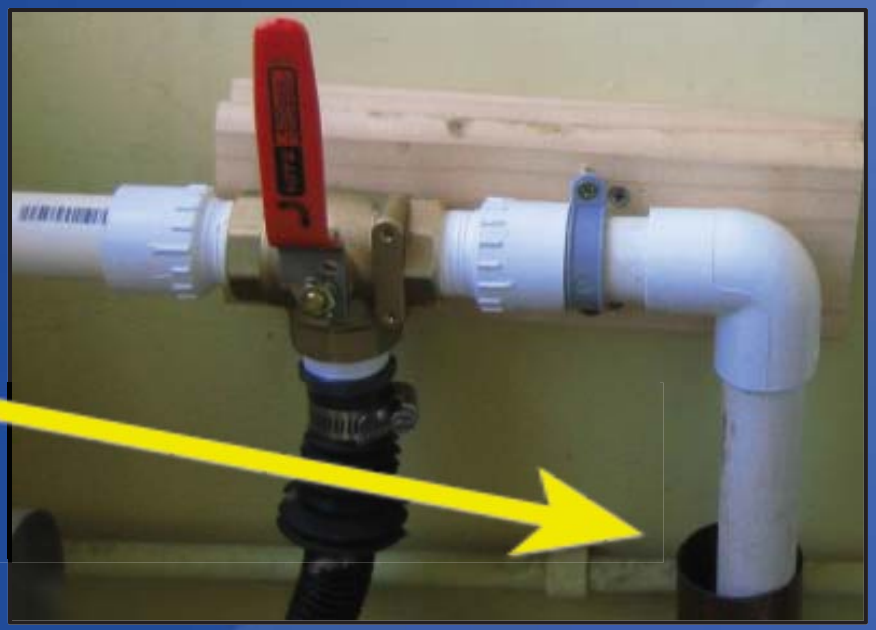
siphon protection:

auto-vent is placed
on side that goes to garden

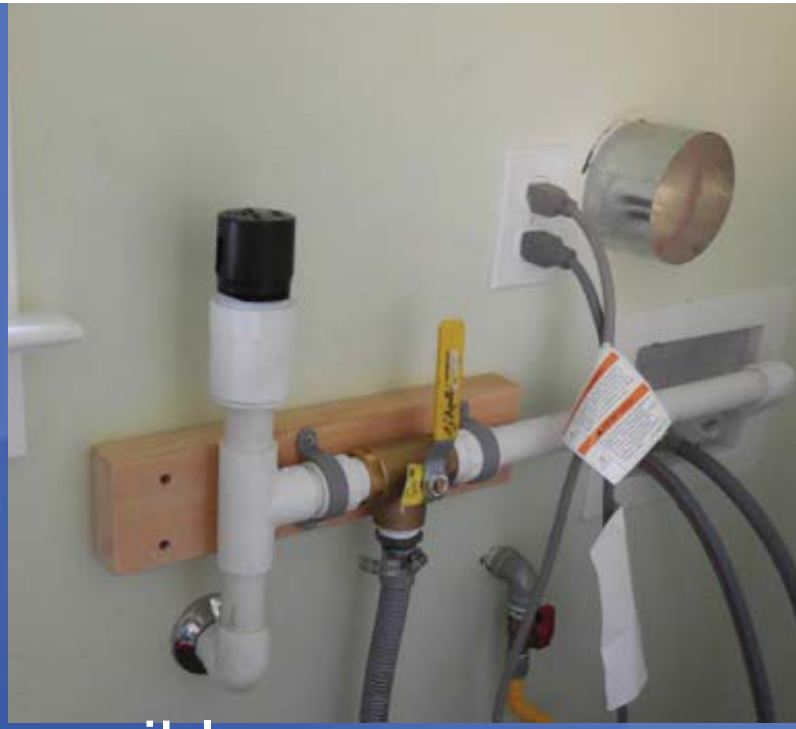
(note labeling and owner's manual posted)

loose fit at sewer connection
breaks vacuum

on side that goes back to existing drain



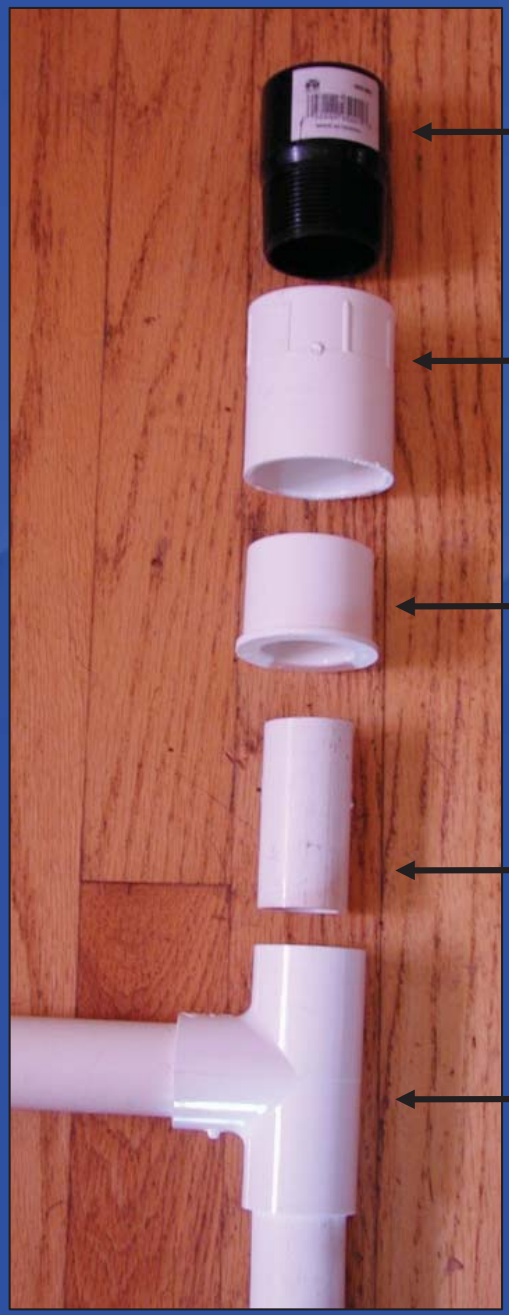
“auto vent”
“studor vent”
“air admittance valve”



~installed at high point
~visible and accessible
~indoors or outdoors

prevents siphoning of refill water to garden

assembling the anti-siphon component



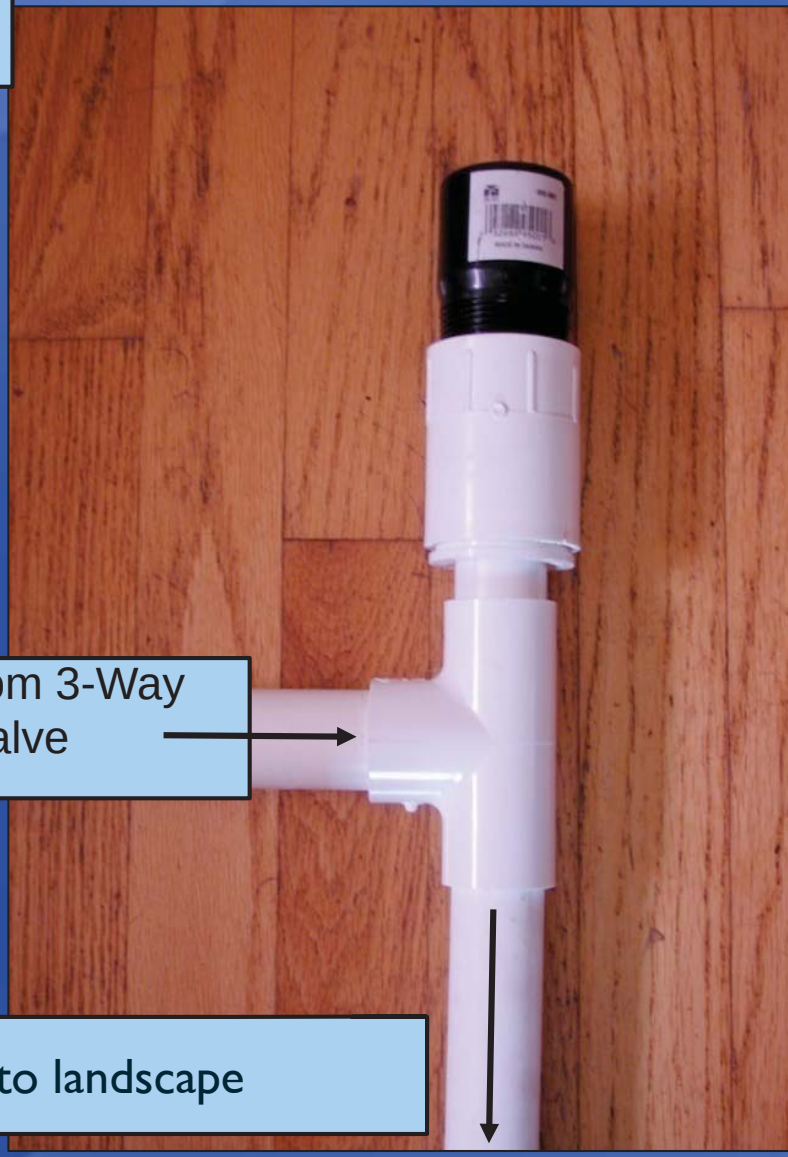
Auto-Vent(1 ½" threads)

1 ½" PVC female Adaptor
FPT x Slip

Reducing bushing
1 ½" x 1" slip

1" PVC Pipe

1" PVC Tee



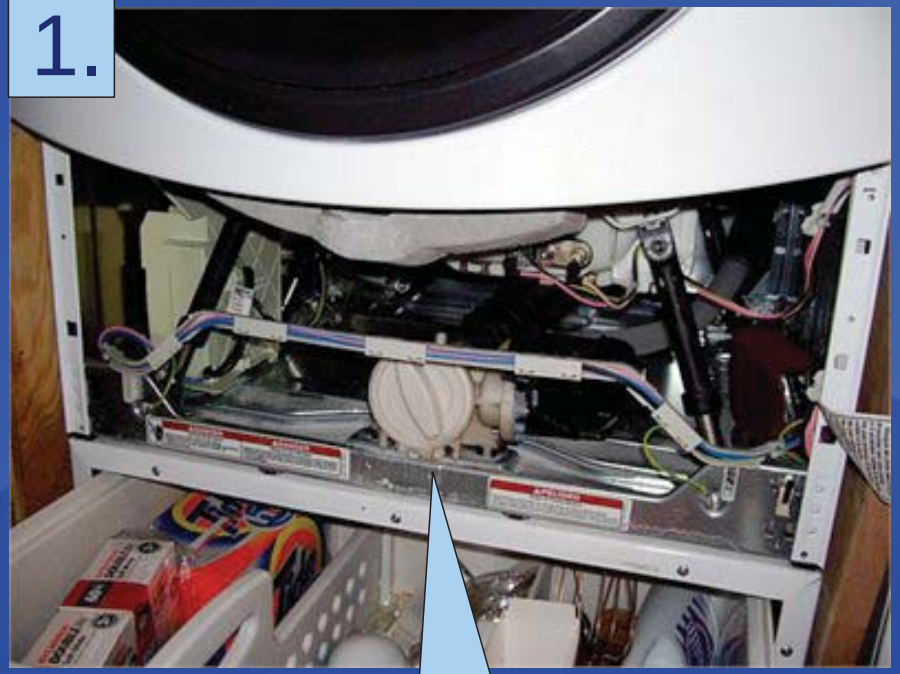
Flow from 3-Way Valve

to landscape

Photos by: Greywater Action

before you start, clean the pump filter!

1.



Pump filter

2.

Unscrew filter. Be ready for water to come out!

Clean out gunk and debris from filter. Debris will make pump work hard, machine won't drain, and can burn out the pump.

3.

consult the owner's manual
or call the manufacturer of
your particular machine for info

working with PVC pipe

- before gluing, pipe must be clean and dry
- Gorilla PVC Glue is less toxic than regular PVC glue and primer
- apply PVC cement to the inside of the fitting **“hub”** first
- next, apply cement to the outside of the pipe.
- push together quickly, inserting pipe all the way into the fitting, and hold a few seconds
- (pipe will try to push out)

preparing the pipe to exit building

- remember to add the length of pipe that will “slip” into the fitting when figuring your measurements
- to minimize friction, use as few fittings and turns as possible
- If possible, always slope the pipe downward to the outside
- PVC pipe can be cut using either PVC cutters or a handsaw

tips for drilling the exit hole

- drill a pilot hole (or 4 at outer edges of circle)
  - use a long ¼” or smaller bit for the pilot hole
  - use correct bit for your wall/floor
  - (wood holesaw bit, stucco bit, etc.)

Caution: Before drilling, locate the gas, electrical and water shut off to the home.

after confirming there are no obstructions:

- drill hole for 1” PVC using a 1½” bit
- a circle of small holes may be drilled in stucco then the stucco chipped out of the center
- drill from outside in and inside out for clean edges

soaps and products

avoid:

- salt (sodium compounds)
- Boron (borate)
- Chlorine bleach (hydrogen peroxide bleach okay)

recommended products:

- liquid laundry detergent: Oasis, ECOS, Biopac, more
- soap alternatives: Soap nuts, “wonder balls”
- read ingredients: “biodegradable” is not necessarily garden friendly!
- sodium is common in fabric softeners/water softeners

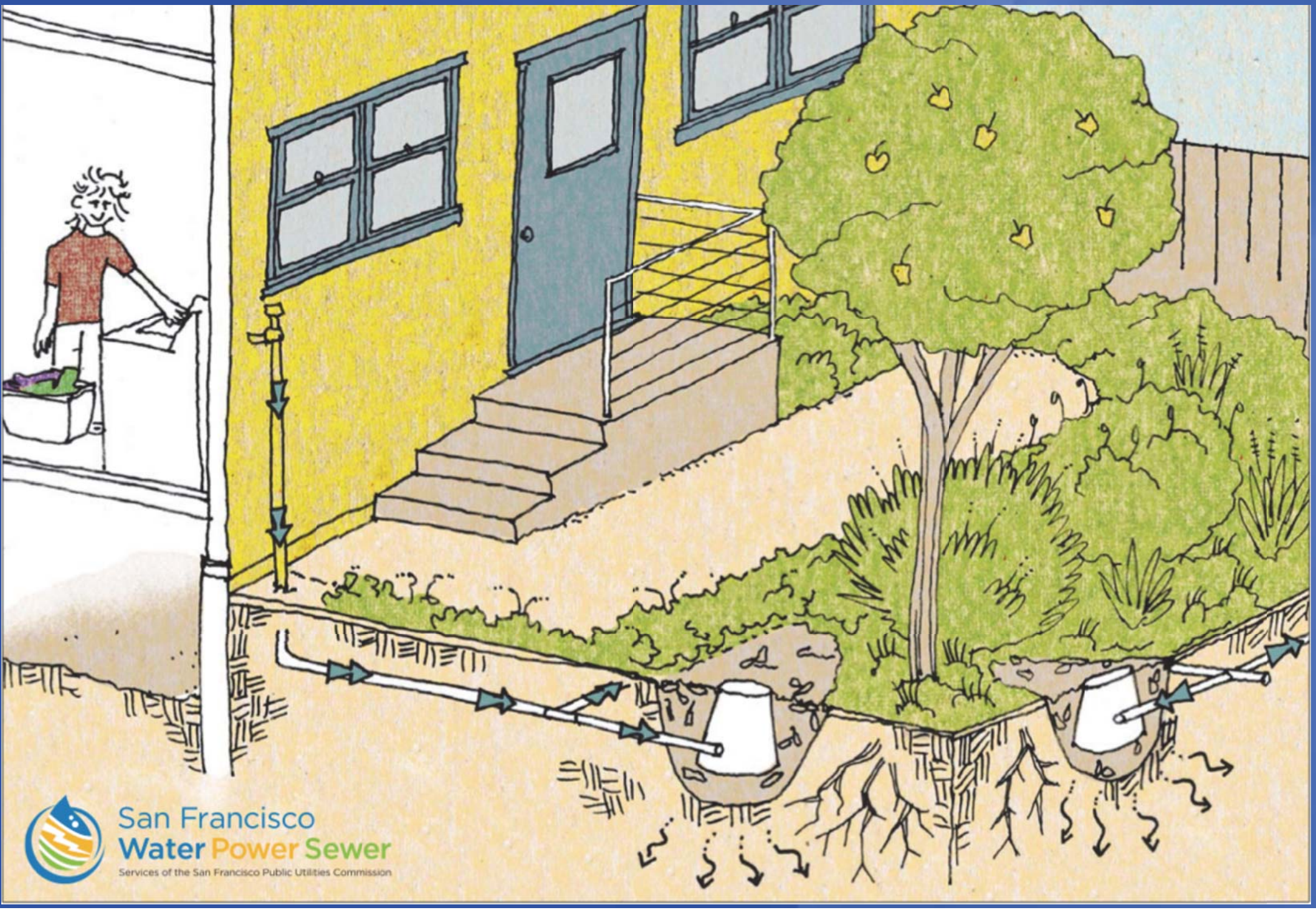
now for the outdoor component:

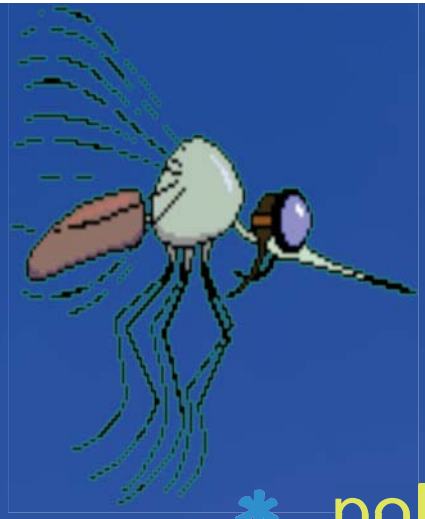
distributing the greywater
in the garden

greywater as part of the bigger picture

Integrated design: Roof catches water, rain infiltrations into basins, rain and greywater grow shade, food, wildlife habitat, and beauty.

inside to outside (SFPUC's Graywater Design Manual)





valid concerns

- pollution of creeks, bodies of water, groundwater
- contamination of soil with toxins or salts
- runoff into storm drains or to neighboring property
- exposure to humans by pooling on surface
- mosquitos
- cross connection and contamination of potable water supply

outside portion of L2L

- determine greywater production
- calculate plant water requirements
- identify what plants to irrigate
- plan the path of travel
- prepare the landscape
- comply with the code

estimate greywater production

1. number of loads of laundry done each week?
2. loads done each day?
3. number of gallons per load?
   - top loading machine uses ≈ 35-50 gallons/load
   - front loading machine uses ≈ 12-25 gallons/load

3. future changes?
   - new machine? change in usage? change in landscape?
   -

Weekly greywater produced=
Loads per week x Gallons per load

NOTE: Consult washing machine manual for actual gallons used per load.

a point of clarification:

use *weekly* greywater production to decide how many plants to water.

use *daily maximum flow* to determine size of mulch basins.

irrigation basins
must be large enough to contain all greywater on site with no run-off to storm drains, bodies of water, neighboring property

"***Ponding or runoff is prohibited and shall be considered a nuisance.***"

deciding what plants to irrigate

Best choices

Trees
Shrubs & Bushes
Vines
Perennials
Large Annuals
Food crops
(greywater mustn't touch the edible portion)

… and not so Great

Lawns
Small or potted plants
Raised beds
PH Sensitive plants
Established & never irrigated
Drought tolerant

Plants with larger root zones do better with irrigation
from the washer- ie. stay happy with laundry water patterns

plant water requirements

general rule of thumb

- for each square foot of the plant's footprint, assume a plant water requirement of ½ gallon per week

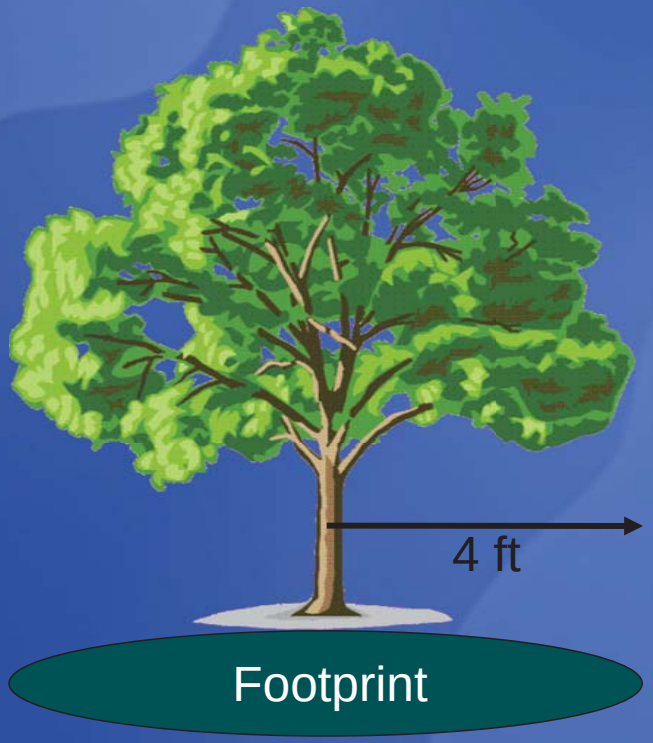
Plant water requirements are affected by microclimates, sun/wind exposure, type of plant, ground water depth, etc.

This rule of thumb number is for peak irrigation time.

The footprint is the area beneath the canopy

finding plant water requirements

How many gallons/week would a fruit tree with a 4 foot radius need during the peak irrigation season?



(At 1/2 gallon per sq. ft.:)

Using πr^2:

3 x 4 x 4 =48 square feet

48/2 = 24 gallons per week during peak months

If a drought tolerant plant, divide by 2 again= 12 gallons/week

path of travel tips

- pipe around obstacles
- try to maintain a downward slope when installing pipes
- distribution points should be within 50 feet on level ground

hardscape!

- go under it
- around it
- remove it
- cut a strip out of it

Photo by: Greywater Action

transition from PVC rigid pipe to HDPE irrigation tubing

1” HDPE

1” PVC

1” barbed by male adapter

1” threaded union

1” male adapter

union allows opening and flushing of system with a hose periodically to remove lint or clogs, or to re-test balance

positioning the transition vertically gives easy access

laying the tubing in the landscape

run tubing along a fence or wall away from foot traffic

~trench into solid ground
~stake
~cover deep enough to protect from sun and traffic
~irrigate on uphill side of the plant

slope considerations

be mindful of the washing machine pump!

- in a flat yard, distribution should be within 50 feet
- if the site is sloped down to distribution points, no rule about distance
- serpentine down hills to slow flow for more even distribution
- irrigate on the up-hill side of plant

- leave one 1” end open

  to protect the pump

Note: If the distribution point is uphill, Laundry to Landscape is not recommended.

serpentining
the tubing
down a slope to
natives around
a redwood tree

a while later...

code language: mulch basin

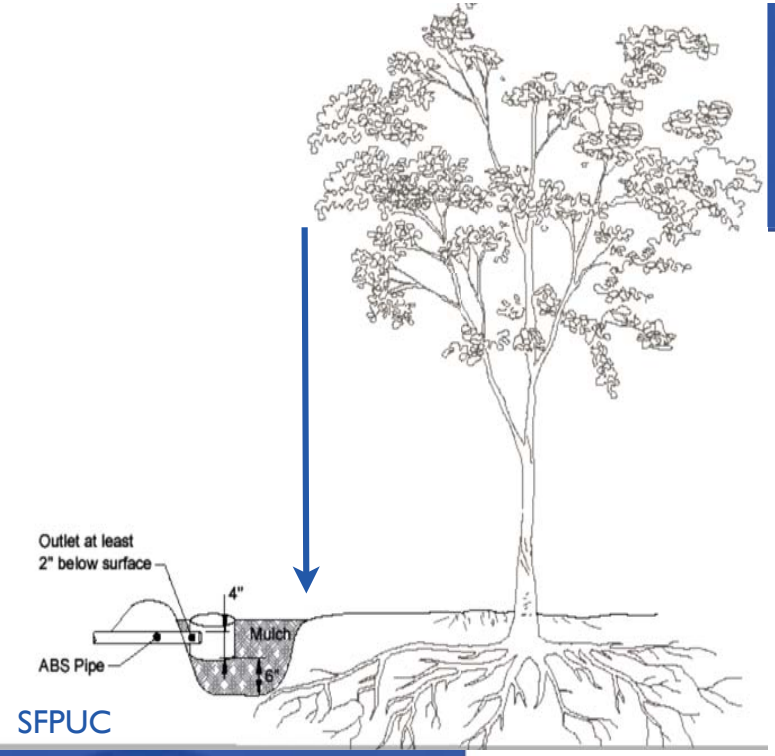
A subsurface type of irrigation ...field filled with mulch or other approved permeable material of sufficient depth, length, and width to prevent ponding or runoff during the gray water surge of a clothes washer...

A mulch basin may include a basin around a tree, a trough along a row of plants, or other shapes necessary for irrigation ...

Mulch must be replenished as required due to decomposition of organic matter. Mulch basins will require periodic maintenance, reshaping or removal of dirt to maintain surge capacity and to accommodate plant growth and prevent ponding or runoff.

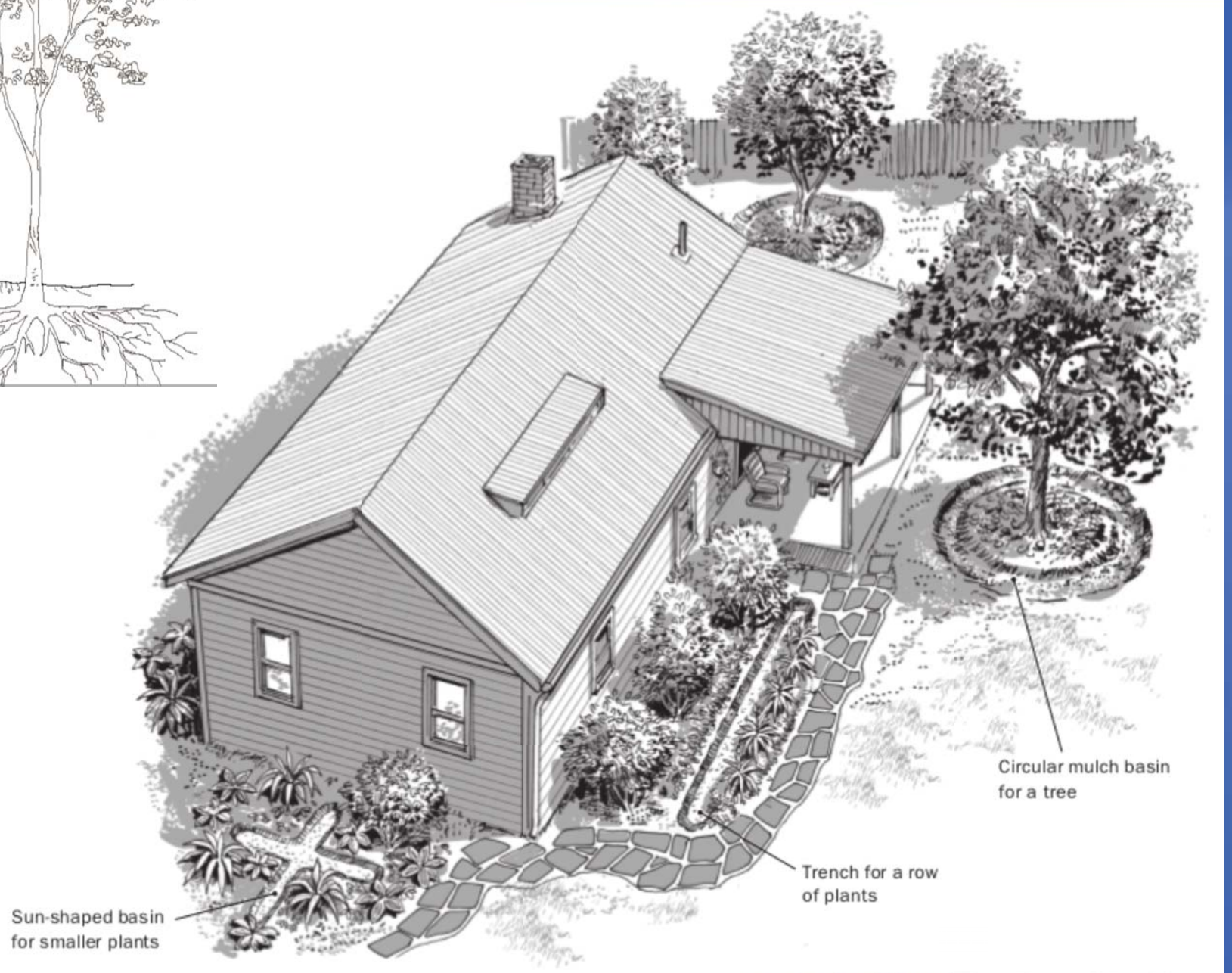
2013 CPC 1602.11.1

mulch basins at drip line of plants



SFPUC

basins can be different shapes



mulch irrigation basins

prevent surfacing; allow greywater to seep slowly into soil

- assuring graywater will not:
  - pond on surface
  - run off of property
  - enter the storm drain

- in clay soil,
  trench 1 sq. ft.
  for each gallon
  of greywater
  produced daily

- in sandy loam
  1/2 sq. ft.
  per gallon

Size of basin
will vary based on
amount of greywater
produced,
number of distribution
points,
and soil type.

photos by Greywater Action

mulch basin sizing

anticipate where future drip line will be when tree matures!

Example: (Clay soil)
3 loads of laundry (on Saturdays)
at 20 gallons/load = 60 gallons

6 trees to irrigate

60/6= 10 gallons per tree.

Each tree needs at least 10 sq. ft. of basin.

1 ft. wide basin around tree with 4 ft. radius has
(using circumference = 2Лr)
2 x 3 x 4' = 24 sq. ft. of mulch basin

outside in the garden:

1” HDPE main

1/2” poly branches to mulch shields...

set in mulch basins

setbacks for mulch basin irrigation fields

2 ft from buildings

1.5 ft from property lines

100 ft from wells or creeks

5 ft from septic tank

4 ft from leach field

3 ft above groundwater table

greywater freefalls onto mulch at bottom of mulch shield disperses in mulch basin

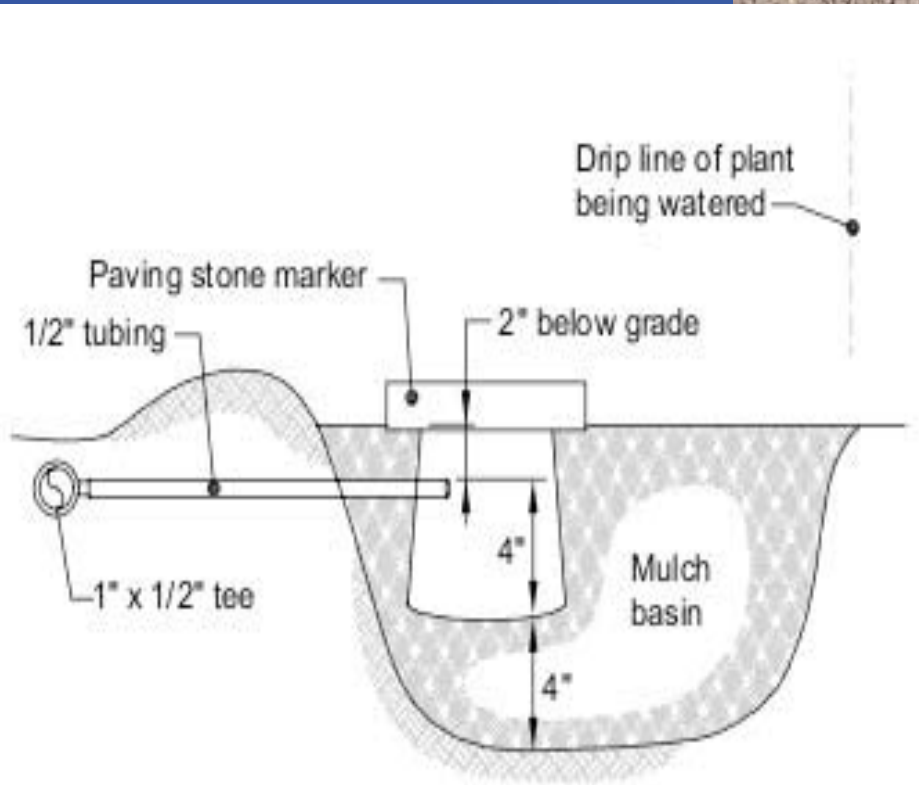
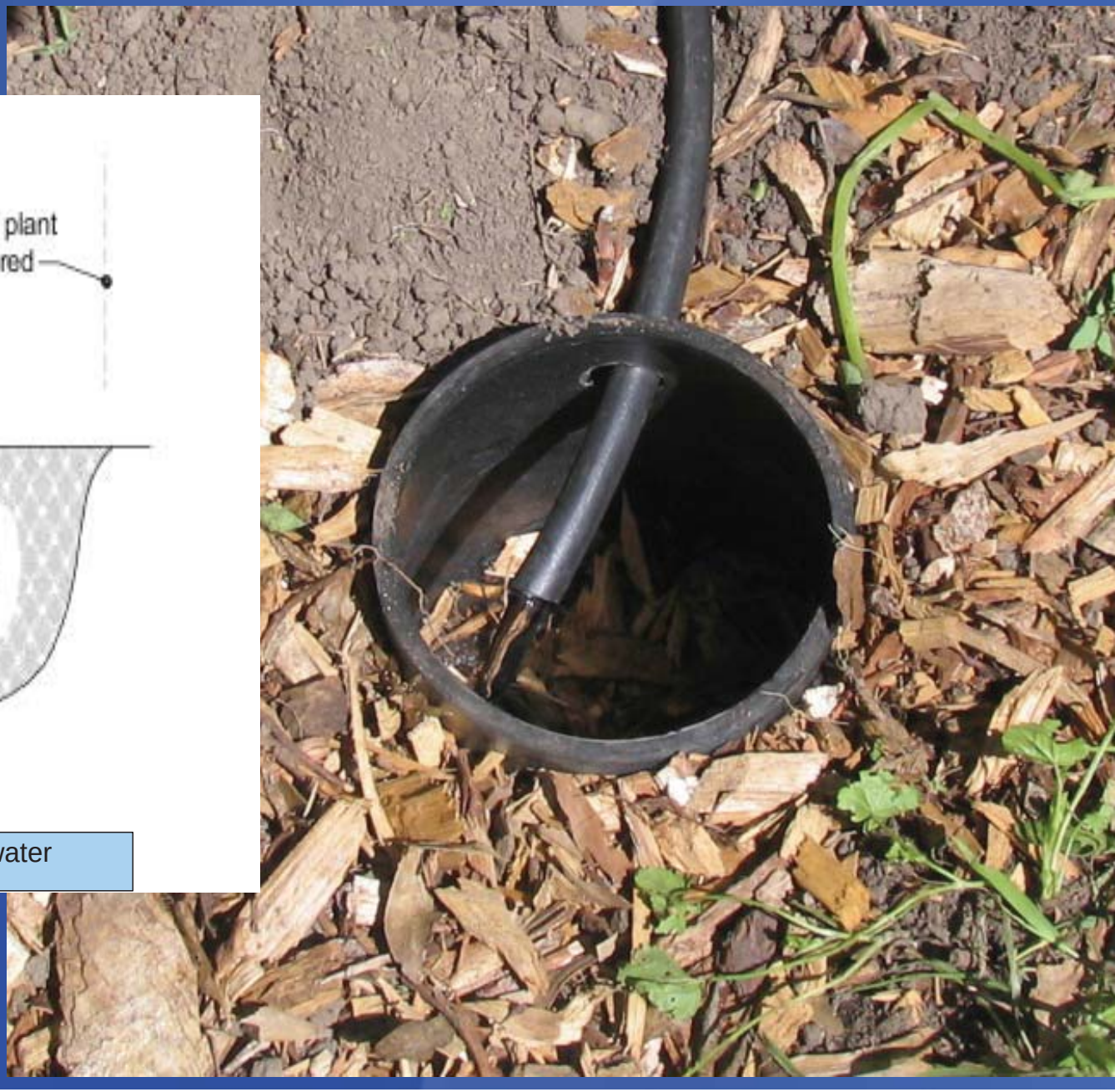


Figure 4. Mulch shield placement.

Image from SFPUC manual on greywater



mulch shields

The discharge point of any greywater ...subsurface irrigation field shall be covered by at least (2) inches of mulch, rock, or soil, or a solid shield to minimize the possibility of human contact.

Greywater 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. *2013 CPC 1602.1 (D) & (E)*

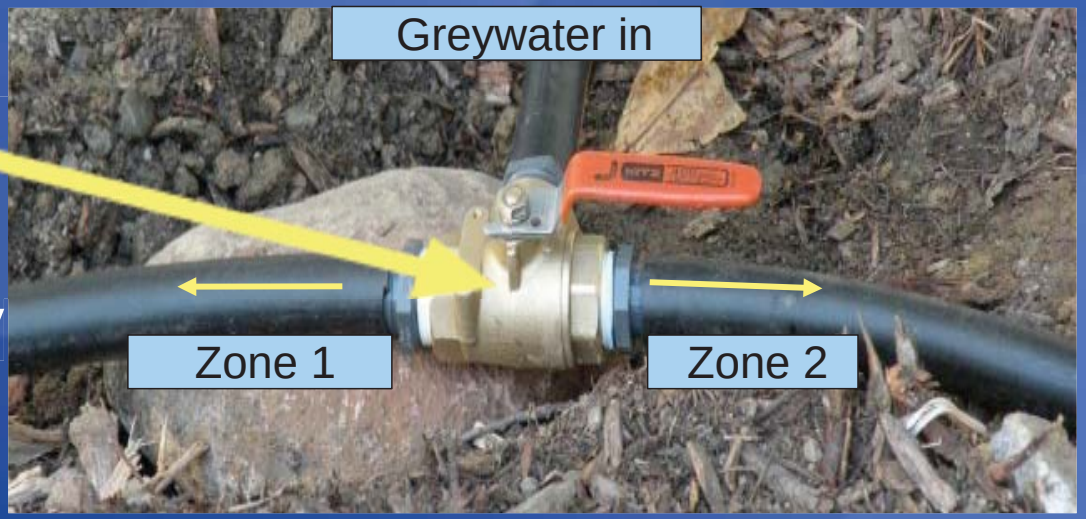
~prevent roots from clogging outlet

~mark location of outlets for monitoring of flow

~allow greywater to sink into mulch below and spread around basin

two zone systems
if producing lots of greywater

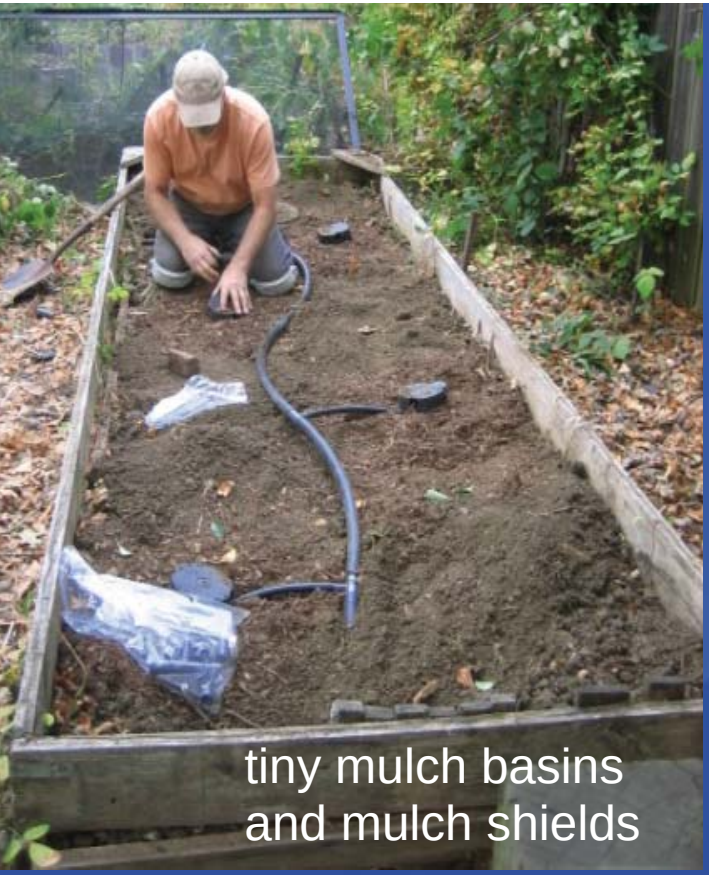
a 3-way valve in the landscape can create two “either/or” zones-- must be switched manually



or

a 1” ball valve can allow occasional flow to a secondary zone via 1” branch main

photos by Greywater Action



tiny mulch basins
and mulch shields

raised beds?

remember,
no root veggies

edible part
of plant
must not touch
greywatered soil

drill holes in 1” tubing
(knowing they will clog and need cleaning out)
mulch around tubing
cover with 3 or 4” pipe or flex tubing, cut in half

drip tubing--
(cover with
2” of mulch)

Image: Leigh Jerrard

up into a barrel...

and into mulch shield

preferred method of testing/flushing

adjust system to balance flows

Photo by: Greywater Action

adjust angle of tees

(use the curve in the tubing to help)

1/2’ ball valves can help balance flows

hidden distribution points

review: key points for L2L

for laundry only--since machine has internal pump

uses 1” pipe and tube, 1/2” outlets

anti-siphon auto-vent must be at high point

no storage

leave at least one end of 1” tube open

could shorten life of pump

remember the Operation and Maintenance Manual!

An operation and maintenance manual shall be provided to the owner.

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 gray water system.

2013 CPC 1602.1 (H)

finishing up

stake and bury tubing

check for leaks inside

paint exposed PVC pipe outside

seal holes in walls/floor

post signs

post maintenance manual

get graywater friendly soap

do your laundry and water your plants!

painting and sealing

Photo by: Greywater Action

Paint exposed PVC to protect against UV damage

Seal hole with adhesive water sealant.

Have you complied with the Code?

System Check List

- Have you installed the 3-Way Valve?
  - Is it visible and accessible?
  - Is it labeled appropriately?
- Have you posted a Maintenance Manual?
- Is the anti-siphon installed?
  - Is it on the landscape side of the system?
  - Is it the highest point of the system?
  - Is it visible & accessible in case of leaks?
- Is the greywater discharging 2” below the surface?

Have you complied with the Code?

System Check List (continued)

- Will all graywater be contained on site?
- All discharge points (not the pipe) comply with setback requirements?
  - 1.5 feet from property line
  - 2 feet from buildings
  - 100 feet from waterways and wells
  - 5 feet from septic tank
  - 4 feet from leach field
  - 3 feet above groundwater table

Have you complied with the Code?

System Check List (continued)

- The system is not connected to any potable water supply.
- Water used to wash diapers or similarly soiled clothing will not be diverted to the landscape.
- No hazardous chemicals will be diverted to the landscape.

break!

then the hand’s on play

http://www.thisoldhouse.com/toh/tv/ask-toh/video/0,,20565323,00.html

basics of plumbing biology / terminology

male threads screw into female threads

NPT=National Pipe Thread, the standard

male threads = MPT; female = FPT

hose threads = HT, are different than NPT pipe threads

adapters are fittings that transition from one method of connecting to another...glued to threaded, glued to barbed, barbed to threaded, etc

bushings are fittings that insert into other fittings in order to reduce the size of the pipe coming out that side

the end of a pipe can be glued into a “slip” fitting

activity:

with a group,
help each other ID the parts provided--
what is their function?

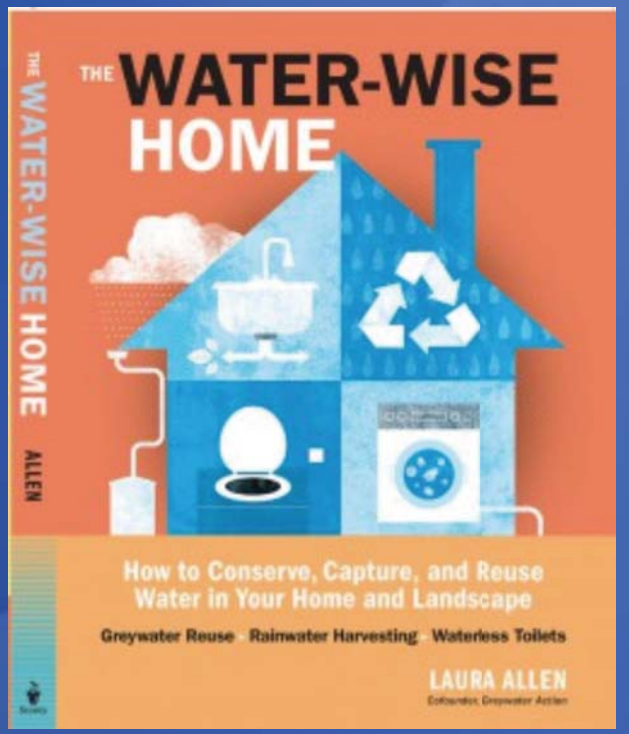
then, mock up a Laundry to Landscape system!
then share your creation
and get feedback

Resources for Laundry 2 Landscape Systems:

Greywater Action: www.greywateraction.org
Oasis Design: www.oasisdesign.net
Excellent how to video from Ask This Old House: “Graywater, Small Engines”

Step-by-step, how to build an L2L System:
San Francisco Graywater Design Manual for Outdoor Irrigation- download for free at sfwater.org (search for “graywater”)
The Water-Wise Home by Laura Allen
Create an Oasis with Greywater by Art Ludwig

Parts:
Barron Park Supply Company, Mountain view:
http://www.barronparksupply.com
The Urban Farmer Store (SF) parts for L2L systems:
http://www.urbanfarmerstore.com
http://www.gray-2-green.com/
http://cleanwatercomponents.com/store/greywater

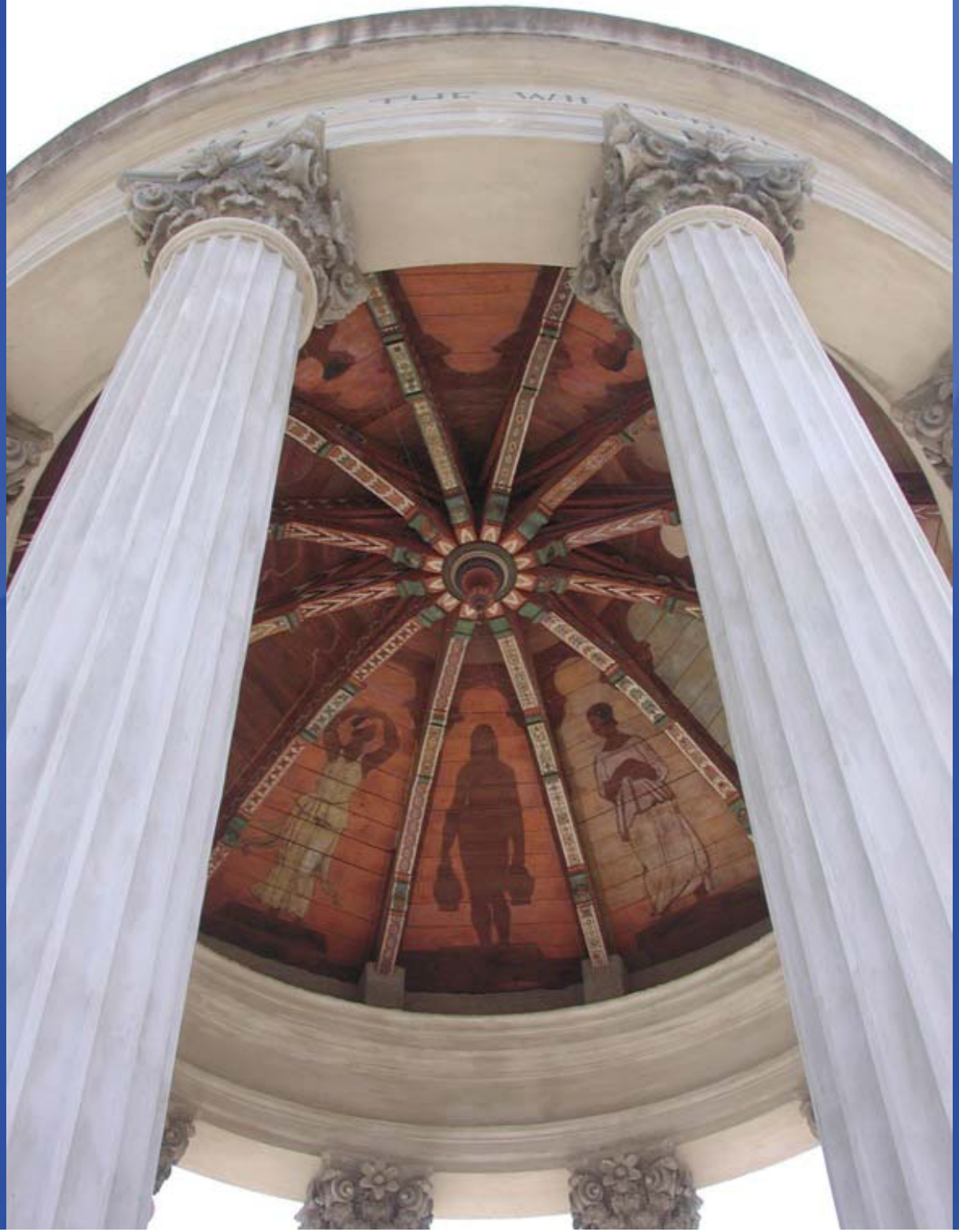


http://greywateraction.org

~~attend a workshop to get
hand's on practice
installing a real system

~~find an installer to hire

~~more information and images
of system installations



treasuring our water

alameda creek
water temple