

Implementation of Graywater Reuse in the State of Colorado

Sybil Sharvelle

Larry A. Roesner

CSU Urban Water Center

Colorado WaterWise

October 25, 2013

Graywater use is legal in Colorado!

May 15, 2013

THE ROCKY MOUNTAIN
COLLEGIAN



LAUGHING WITH A MOUTH FULL OF B |

[Home](#) [News](#) [Sports](#) [Opinion](#) [Weekender](#) [Classifieds](#) [RamTalk](#) [Advertise](#) [Print Edition](#)



Gov. Hickenlooper signs Graywater Bill into Colorado law

By [Mariah Wenzel](#)
May 15, 2013



Sitting in front of a Colo. flag, a U.S. flag and the CSU banner in CSU's Bioengineering building, Gov. John Hickenlooper signed the final draft of House Bill 1044, approving the use of graywater in Colorado homes and businesses.

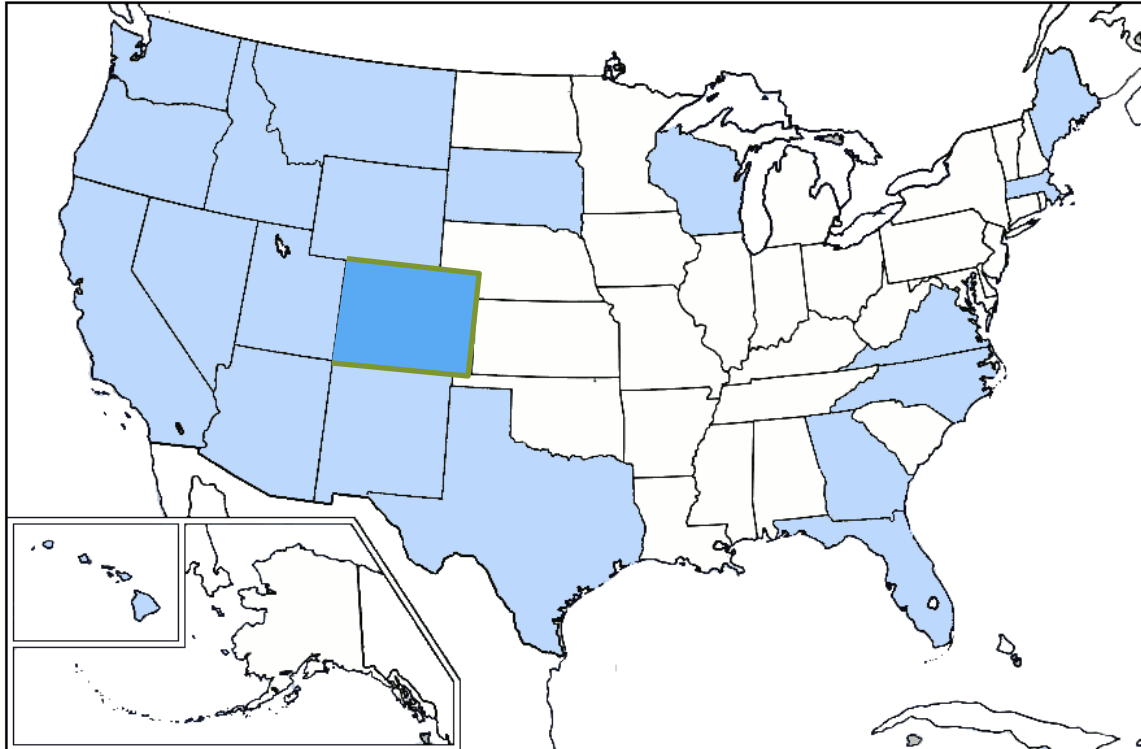
"Ladies and gentlemen," Hickenlooper said as he made the last swipe with his pen, "It's a law."

MUSIC


FortCollinsAudio.com



States with Graywater Regulations



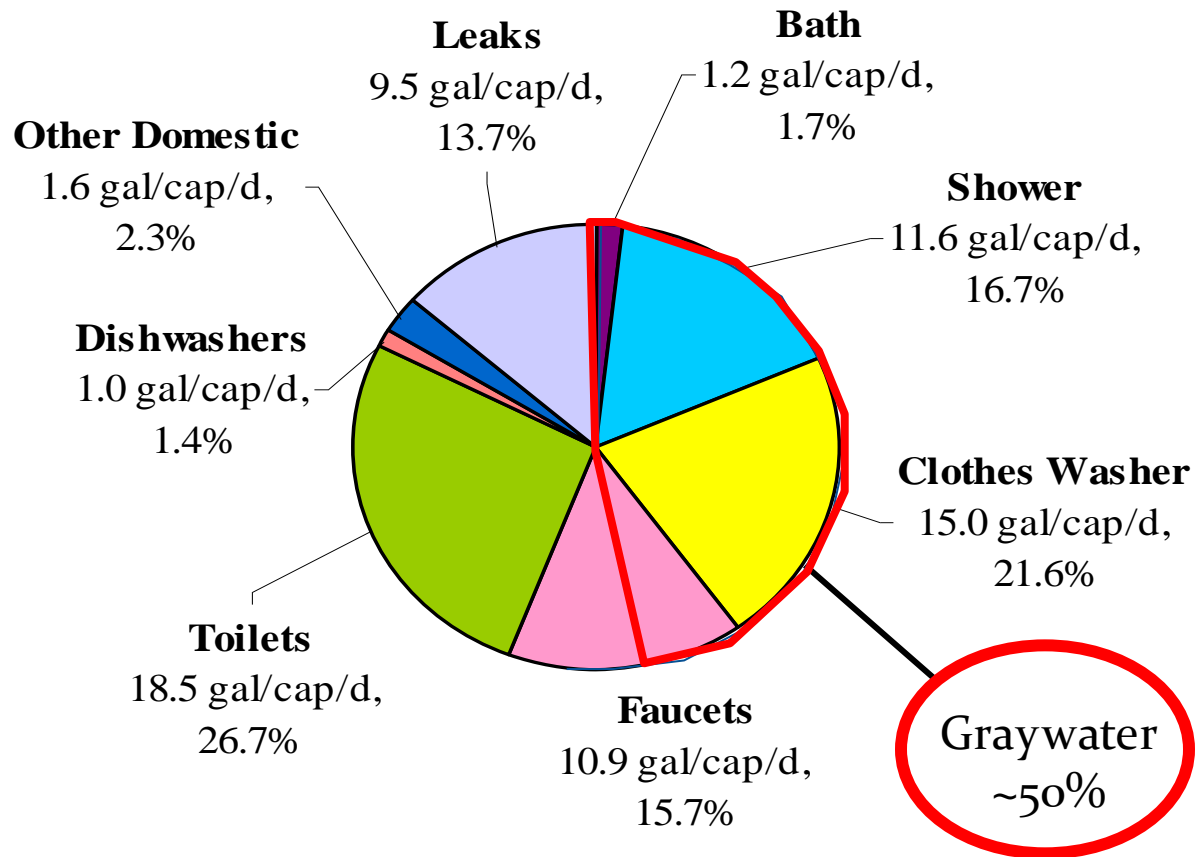
 States that allow graywater reuse

 States that lack a graywater regulation or don't allow graywater reuse

Graywater Defined

- Excludes
 - Toilet water
 - Kitchen water
 - High organics
 - Food born pathogens
- Includes
 - Shower/bath water
 - Laundry water
 - Wash basins

Graywater production



Source: AWWARF

Possible Water Savings

- Colorado's Front Range population is expected to grow from 4.3 to 6.2 million persons by the year 2035, increasing residential water demand by 285,000 ac-ft/yr.
- Use of residential graywater for toilet flushing and residential landscape irrigation in new housing developments could reduce this demand by 30%. The realized water savings of 85,000 ac-ft/yr represents a significant reduction in the water supply gap.
- Graywater use for toilet flushing reduces household wastewater flows by 50%, resulting in a significant reduction in capital outlay by wastewater utilities for new facilities and operating costs to treat wastewater from new developments, thus reducing energy costs, and the overall carbon footprint.

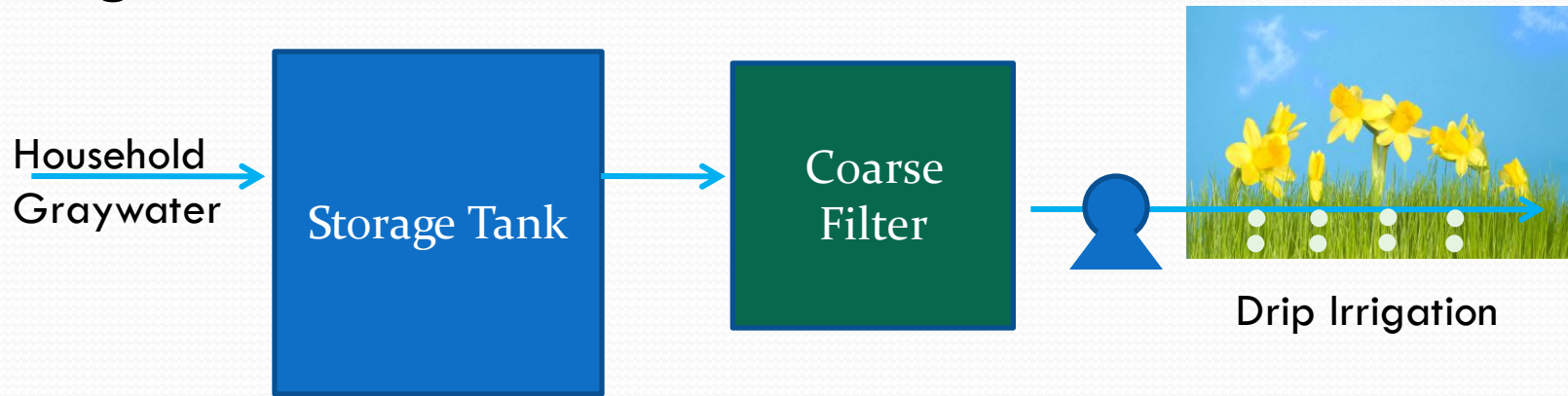
Graywater Quality

	Graywater (mg/L)	Domestic Wastewater (mg/L)
Chemical Oxygen Demand (COD)	77-240	250-800
Biochemical Oxygen Demand (BOD)	26-130	160-300
Total Suspended Solids (TSS)	7-207	390-1230
Total Nitrogen (TN)	0.36-0.64	20-70
Total Phosphorus (TP)	0.28-0.779	4-12
Total Coliform (CFU/100mL)	6.0×10^3 - 3.2×10^5	10^6 - 10^9
E. Coli (CFU/100mL)	<100-2800	-

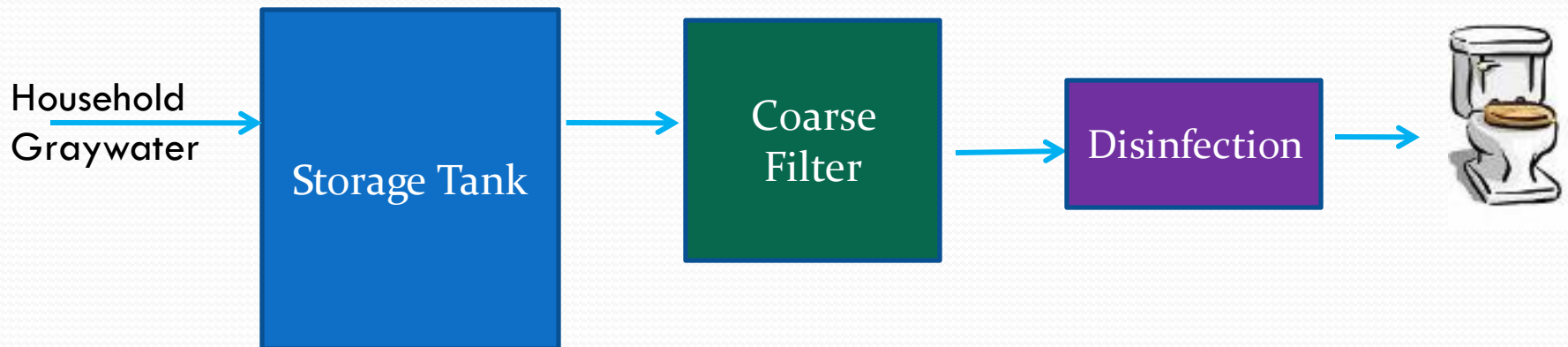
Sources: Eriksson et al. , 2003 & Metcalf & Eddy, 1991

Domestic Graywater Reuse

Irrigation



Toilet Flushing



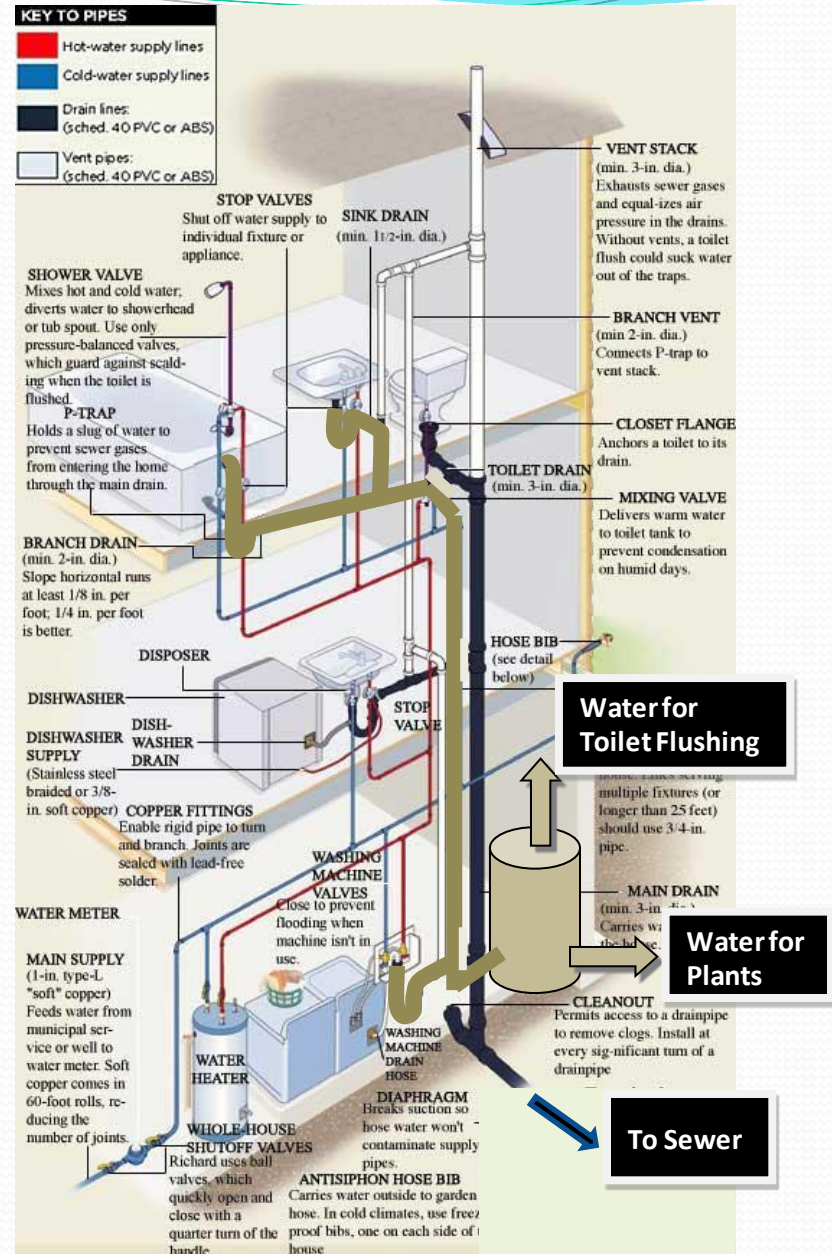
Installing Graywater Reuse Systems

Simple indoor systems for graywater reuse



Source: http://images.google.com/images?q=graywater&oe=utf-8&rls=org.mozilla:en-US:official&client=firefox-a&um=1&ie=UTF-8&ei=81eyS_fGFZOzswOL89z9AQ&sa=X&oi=image_result_group&ct=title&resnum=4&ved=oCCgQsAQwAw

Separate Graywater Plumbing

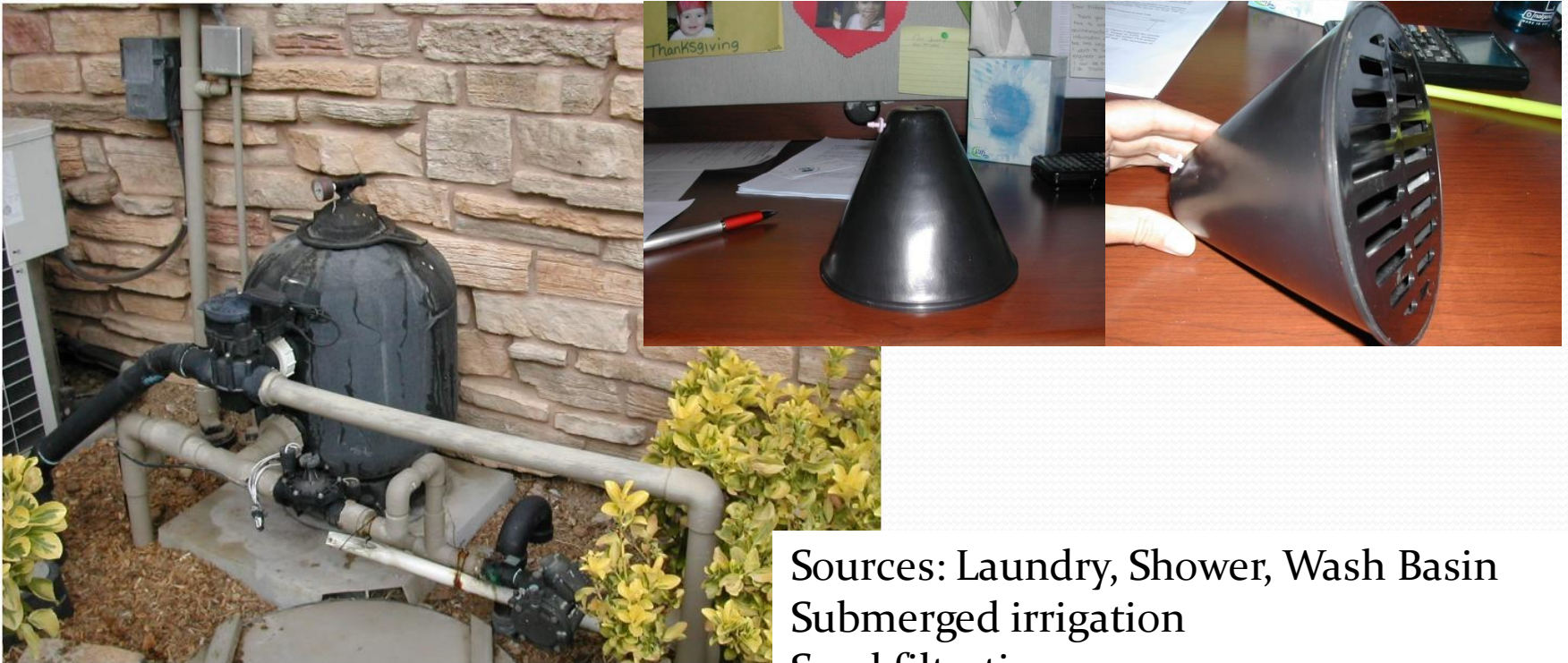


Texas –Simple System

- Hose from laundry machine moved throughout the yard

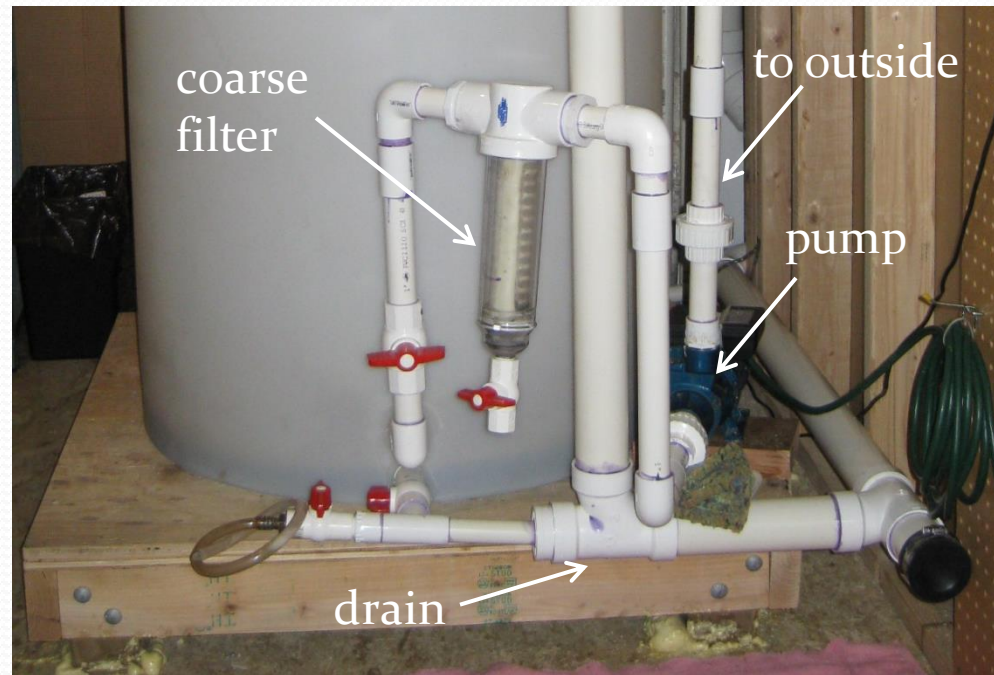
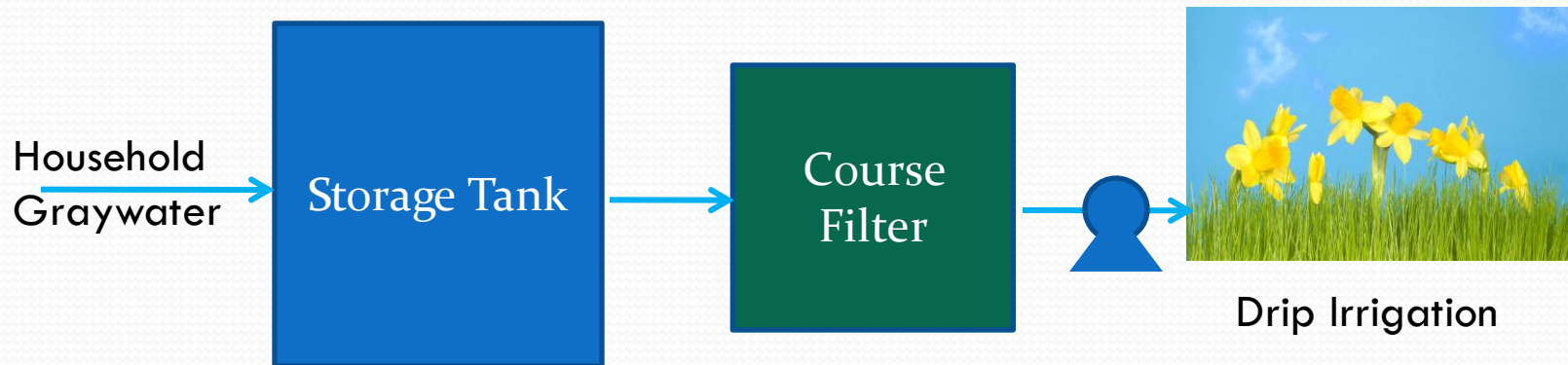


California – More Complex



Sources: Laundry, Shower, Wash Basin
Submerged irrigation
Sand filtration

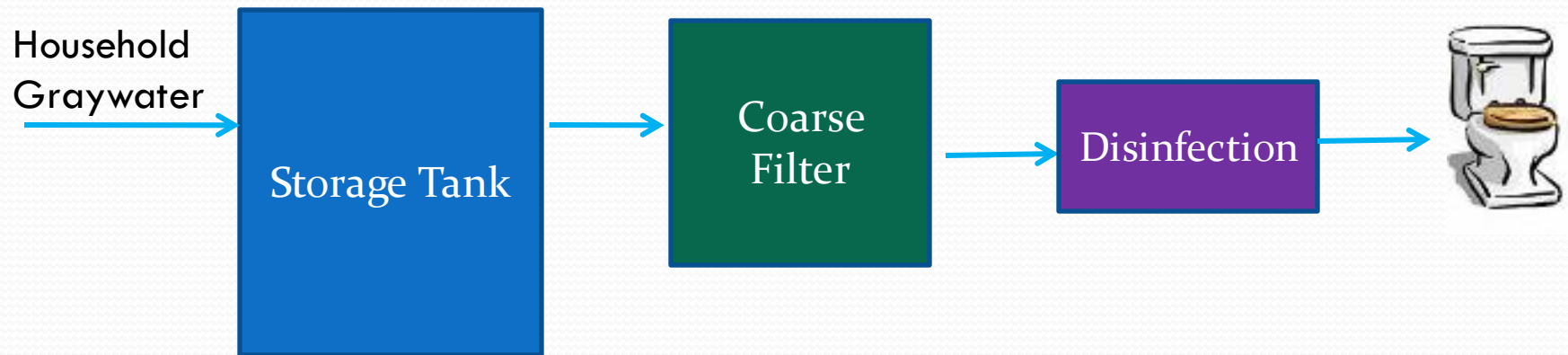
Graywater Irrigation



Graywater Irrigation



Graywater toilet flush system



CSU Aspen Residence Hall

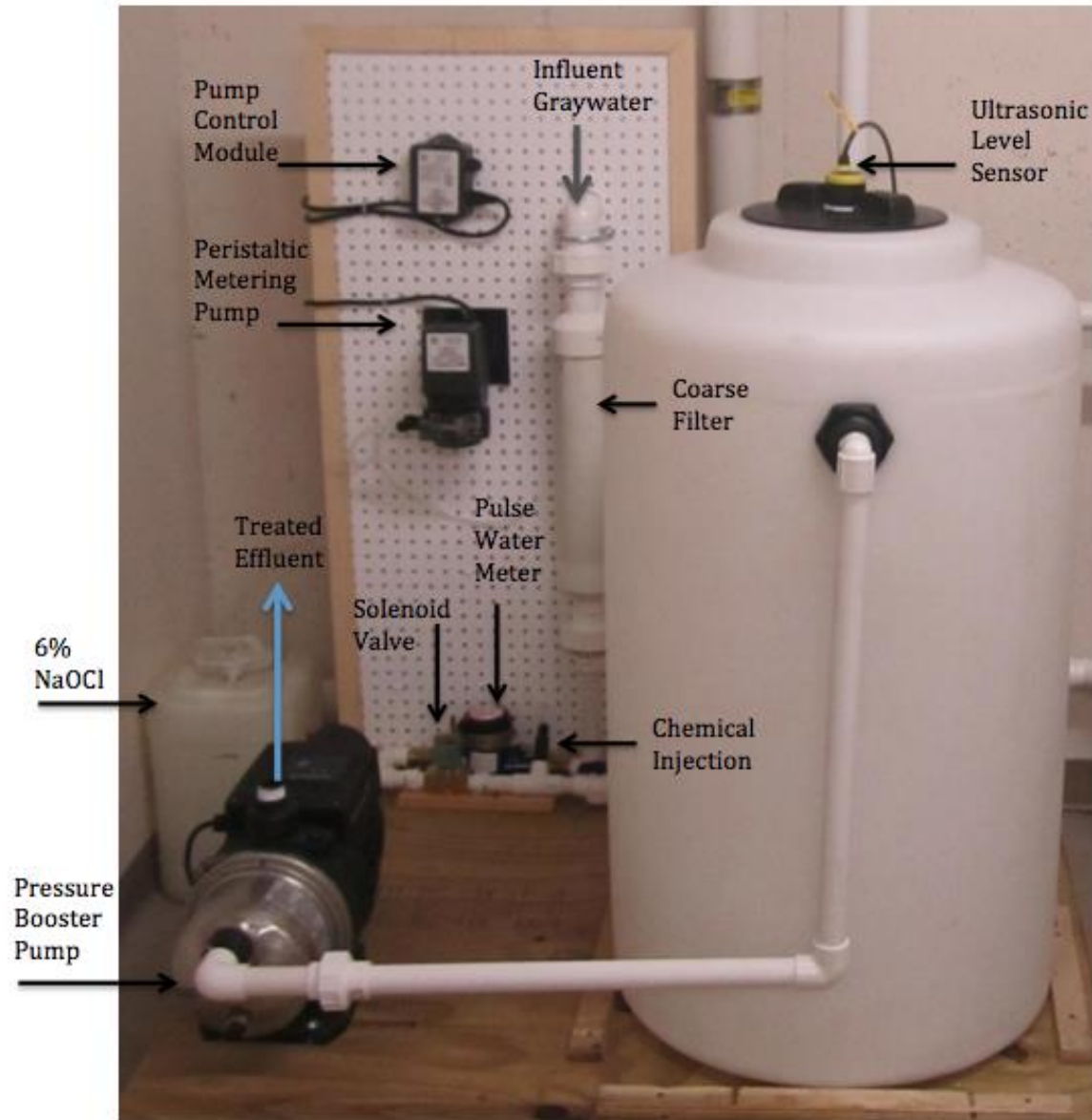
potable make-up

vent

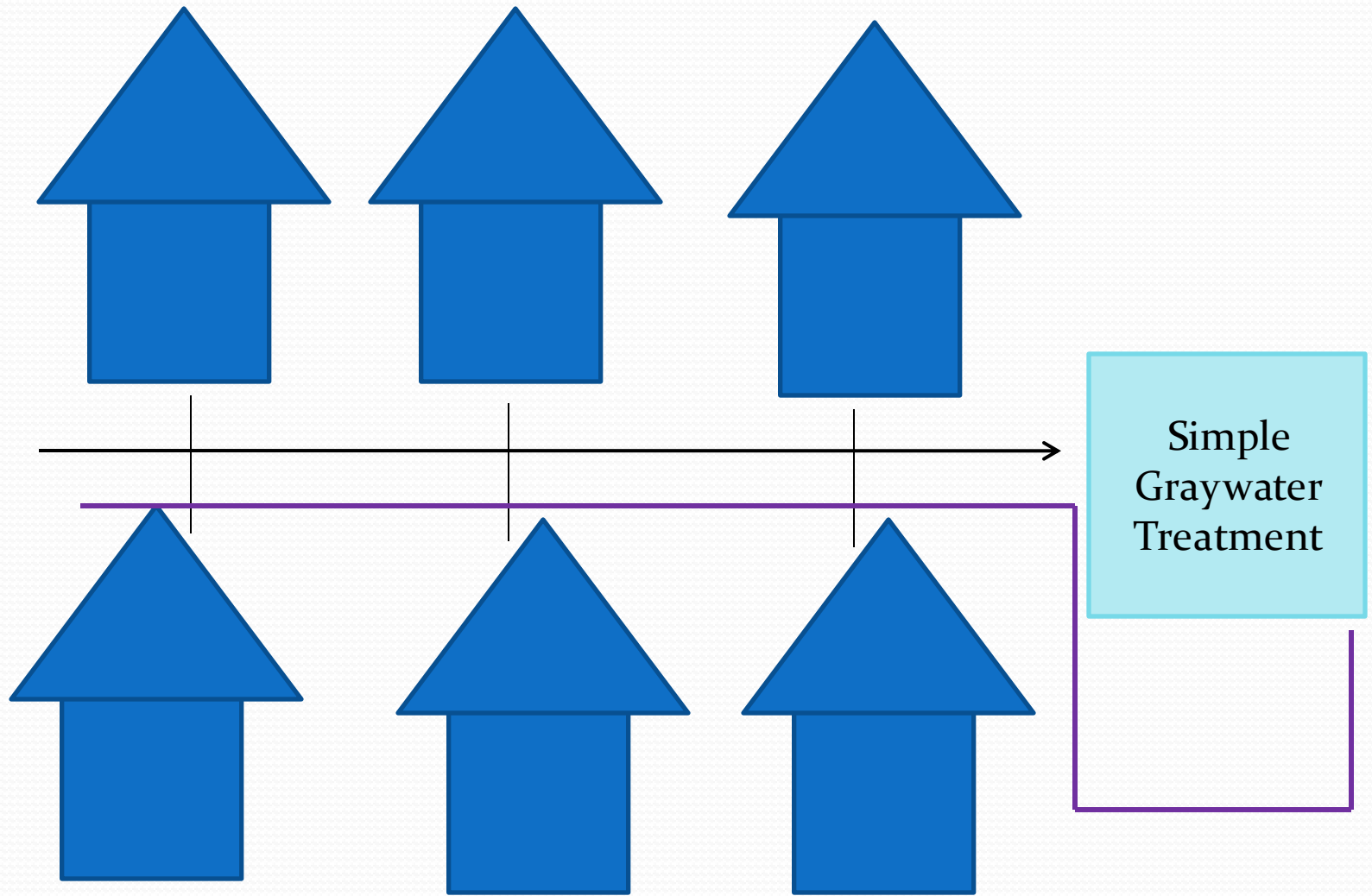
storage tanks



System Installed at Aspen Hall



Neighborhood Scale Graywater Treatment



Graywater Constructed Wetland on CSU Campus



Implementing Graywater Use in Colorado

Status of the Graywater Regulation

- Legislation passed in May, 2013 to allow use of graywater
 - Defines graywater
 - Allows use of graywater
 - Graywater may be applied only to uses that are allowed by the water sources' well permits and water rights
- Cities can choose to or not to allow graywater reuse and subsequently develop ordinances
- Two workgroups have been set up by CDPHE to move forward with rules and regulations
 - Treatment/Use
 - Local Implementation

Process for Implementing Graywater Reuse in Colorado

Step 1-Enablement

Legislature passes
Graywater Bill

Step 2-Regulation

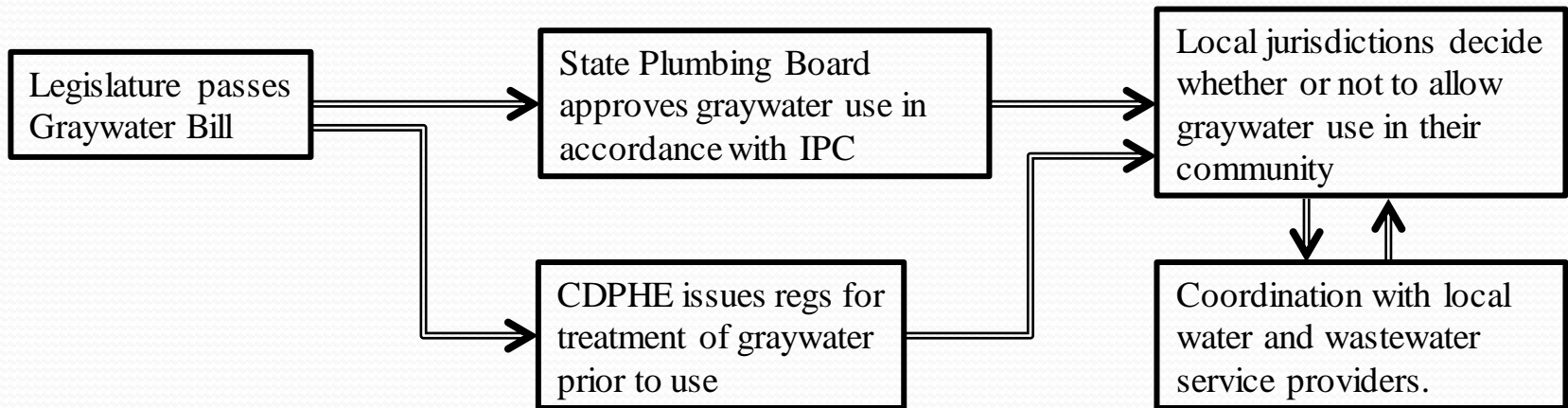
State Plumbing Board
approves graywater use in
accordance with IPC

CDPHE issues regs for
treatment of graywater
prior to use

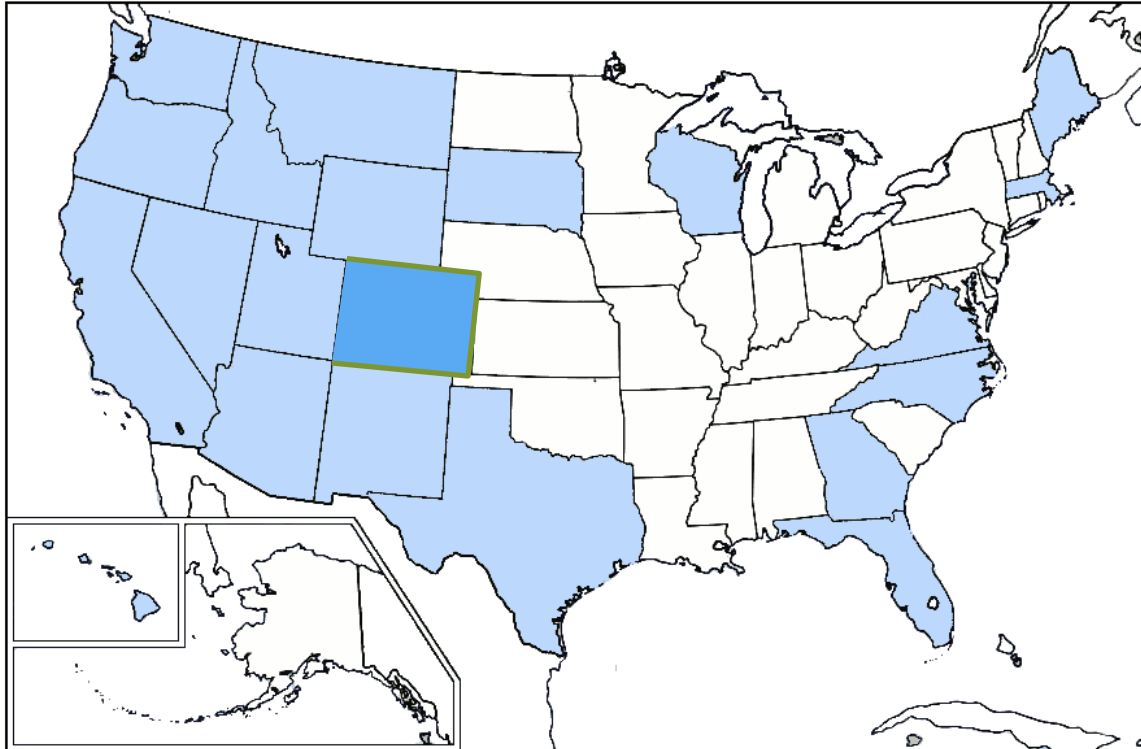
Step 3-Implementation

Local jurisdictions decide
whether or not to allow
graywater use in their
community


Coordination with local
water and wastewater
service providers.



We can build/borrow from others



 States that allow graywater reuse

 States that lack a graywater regulation or don't allow graywater reuse

Graywater Irrigation Regulations

State	Permit Required	Submerged Irrigation	Treated as Septic
AZ	No (<400 gpd)	No	No
NM	No (<250 gpd)	No	No
TX	No (<400 gpd)	No	No
UT	Yes	No	No
CA	Yes	Yes	No
NV	Yes	Yes	No
OK	Yes	Yes	Yes
CO	?	?	?

AZ – Tiered Approach

Tier 1	<400 gpd	No permit
Tier 2	400-3000 gpd	Notice of intent, soil setback and absorption rates (OWS)
Tier 3	>3000 gpd	Tier 2 + WQ requirements

Many states do not impose water quality requirements
For “Tier 1” systems (WA, NM, TX)

Graywater Irrigation Best Management Practices

- No spray irrigation
- Human contact with graywater and soil irrigated by graywater should be avoided
- Do not include kitchen water
- No runoff from property where graywater is applied
- No food crops, except for citrus and nut trees
- There should be no standing water in graywater irrigated areas
- Others.....

Graywater Workgroup Discussions

- Likely will follow tiered approach for graywater irrigation
- Discussion on possible end uses
 - Irrigation and toilet flushing are likely
 - Others may include laundry or cooling towers
- State plumbing board must adopt International Plumbing Code section including use of graywater
- Water quality requirements or system requirements likely for toilet flushing
 - What should these include?
 - Enforcement?

Firefox

SquirrelMail 1.4.21 Chapter 14 - Referenced Standards Weather Forecast Fort Collins, C... Urban Water Center

www.engr.colostate.edu/HHSLab/graywater.shtml

Colorado State University

URBAN WATER CENTER

Department of Civil & Environmental Engineering

Graywater

- HOME
- BACKGROUND
- MISSION
- PEOPLE
- GRAYWATER
- STORMWATER
- CLASSES
- THESIS & PAPERS
- LINKS
- CONTACT

The **Urban Water Center** at Colorado State University is actively involved in a number of research projects investigating the reuse of graywater in individual households under the direction of Dr. Larry Roesner and Dr. Sybil Sharvelle. This webpage provides brief introduction to graywater reuse and the Urban Water Center's involvement in researching this emerging water conservation technique.

What is graywater?

Graywater is the water that drains from bathroom sinks, showers and washing machines in a typical household. Water that drains from kitchen sinks, dishwashers and toilets is not considered graywater because it contains higher levels of organic waste.

Why reuse graywater?

The primary reason for reusing graywater is to reduce a household's demand for potable (fully treated) water. Potable water is treated to EPA drinking water standards which ensure that persons that drink, cook or bathe in that water will not get sick. In most households, potable water is also used to flush toilets and irrigate outdoor landscapes. However, water used for toilet flushing and outdoor irrigation does not need to be treated to such high standards. By reusing graywater for toilet flushing and outdoor irrigation, instead of using potable water, a household can

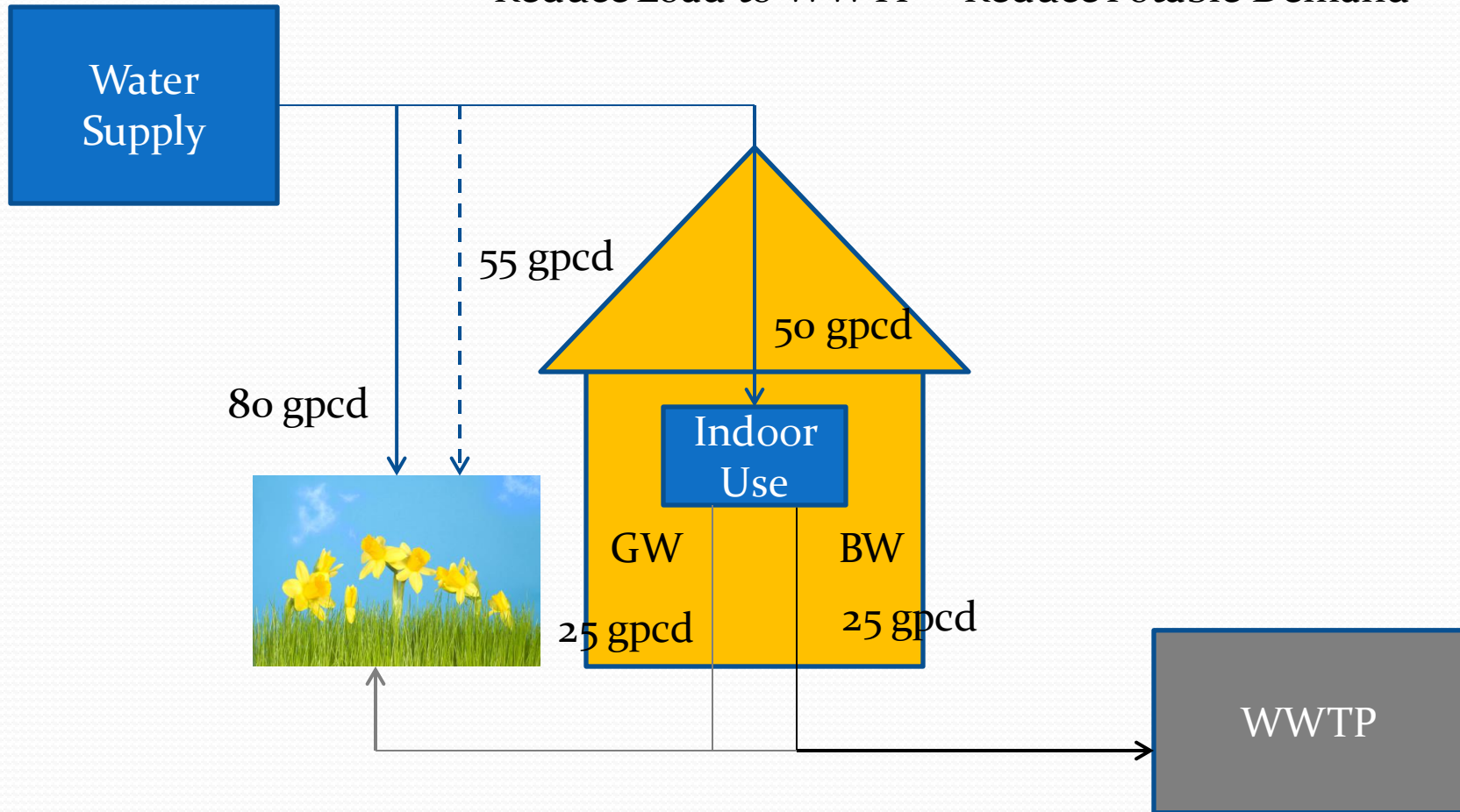
Questions



Appendix

Water Rights?

Reduce Load to WWTP = Reduce Potable Demand



Water Rights?

Reduce Load to WWTP = Reduce Potable Demand

