

Gray water (or greywater) Characteristics and reuse May 18, 2007

On-site wastewater treatment systems

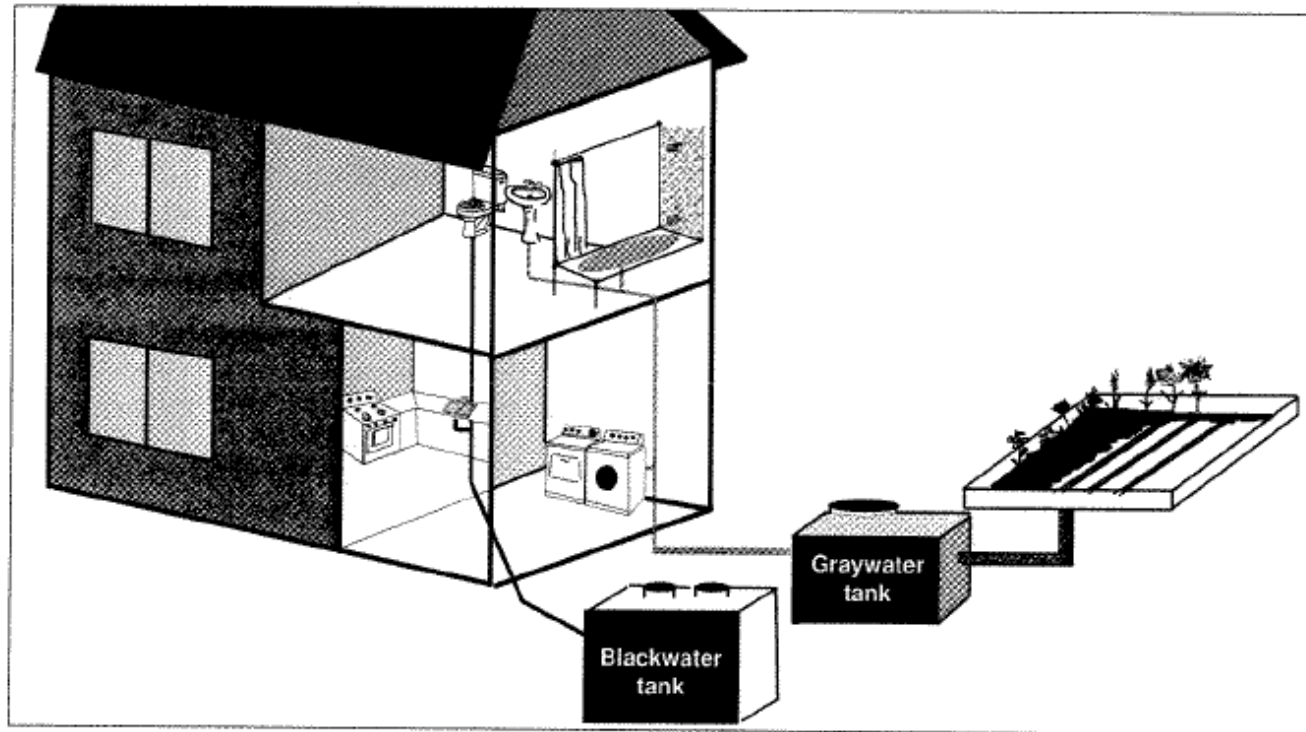


Figure 1: A diagram of separate blackwater and graywater plumbing systems.

Graywater requires separate plumbing system

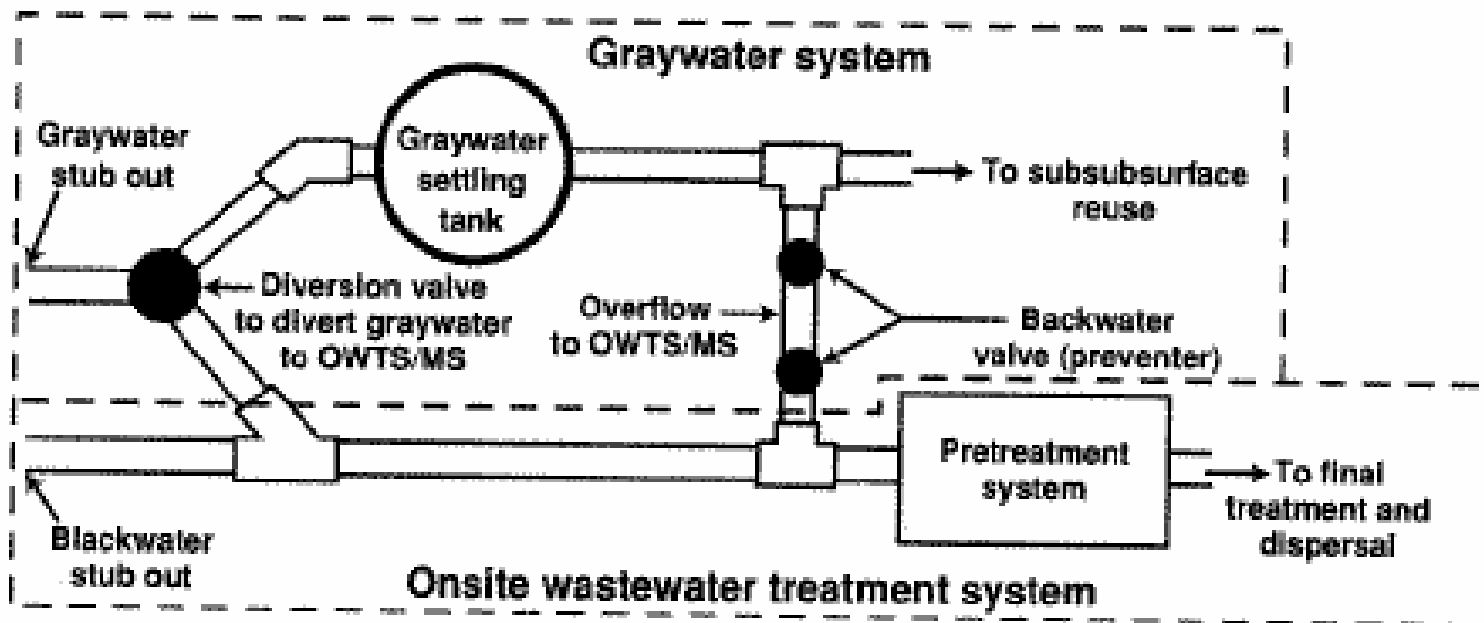


Figure 4. Diverted graywater plumbing system.

Graywater sources and percent of household flow

Source	Percent	Category
Toilet	40	Blackwater
Kitchen waste	10	
Misc	5	Graywater
Laundry	15	
Bath/shower	30	

Greywater

- Various sources of contamination
 - Biological
 - Microorganisms
 - Chemical
 - Dissolved salts – sodium, nitrogen, phosphates, chloride
 - Chemicals – oils, fats, milk, soap, detergents
 - Physical
 - Soil
 - Food
 - Lint

Graywater characteristics versus combined wastewater

- Lower in BOD concentration, 140 to 160 mg/L
- Lower in suspended solids, 50 – 150 mg/L
- Lower in nitrogen concentration, 5 – 10 mg/L
- Lower in phosphorus concentration, 0.4 to 2 mg/L
- More alkaline
- Higher in salt content

Gray water reuse options

- Subsurface applications
 - Irrigation
- Surface applications
 - Irrigation
 - Toilet flushing
 - Water features
 - Cooling water
 - Concrete water
 - Fire sprinklers, hydrants

Gray water treatment

- Source and application affects treatment
- Subsurface needs some treatment
- Above surface
 - Only laundry wastewater
 - Other has to be treated

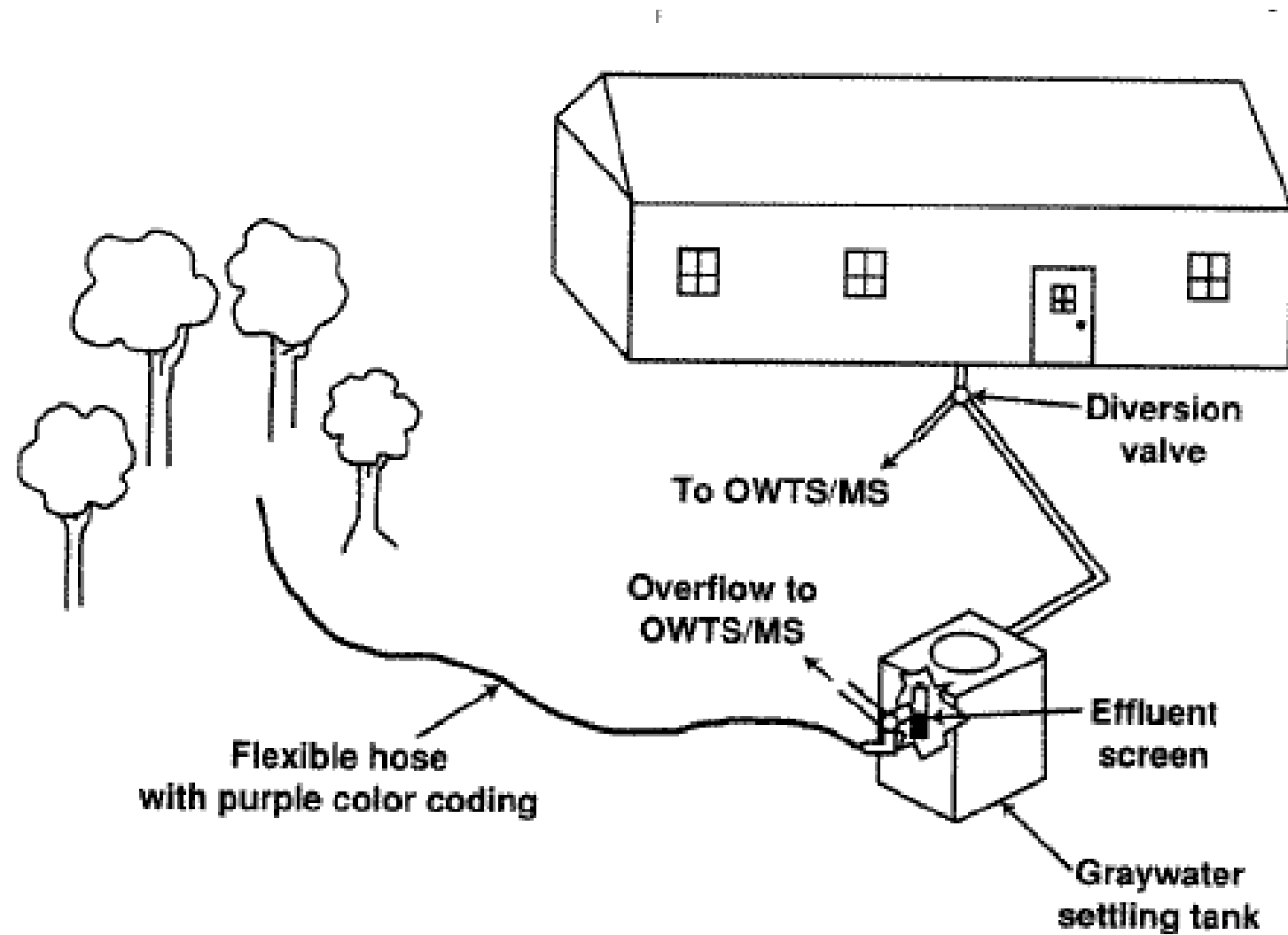
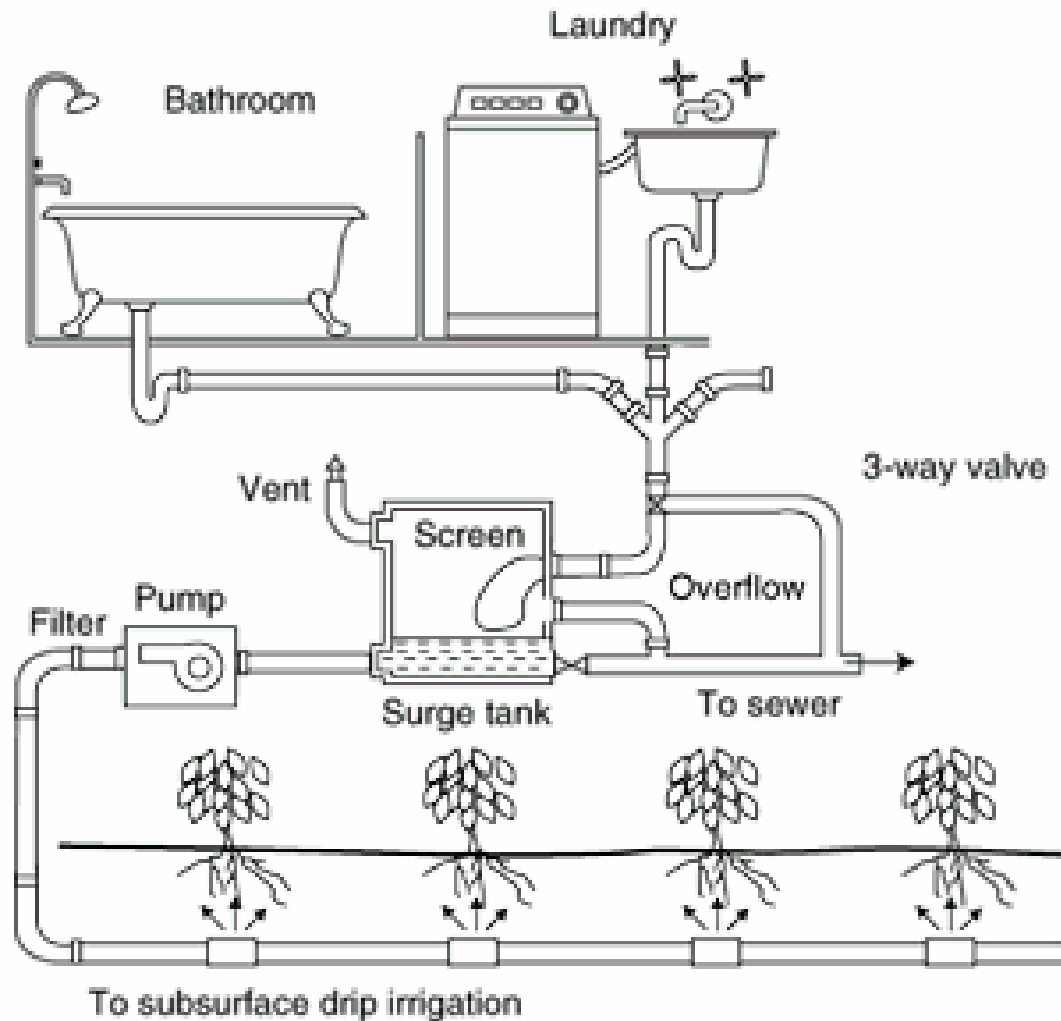


Figure 8. Laundry graywater system with small settling tank and drag hose for irrigation.

Greywater Reuse

- Direct
 - Divert water
 - Filter before use for irrigation
 - No kitchen water used
 - No storage of untreated water
- Collect, treat, store, and use
 - Treatment processes vary
 - With disinfection, may be used for surface irrigation

Greywater Diversion Example



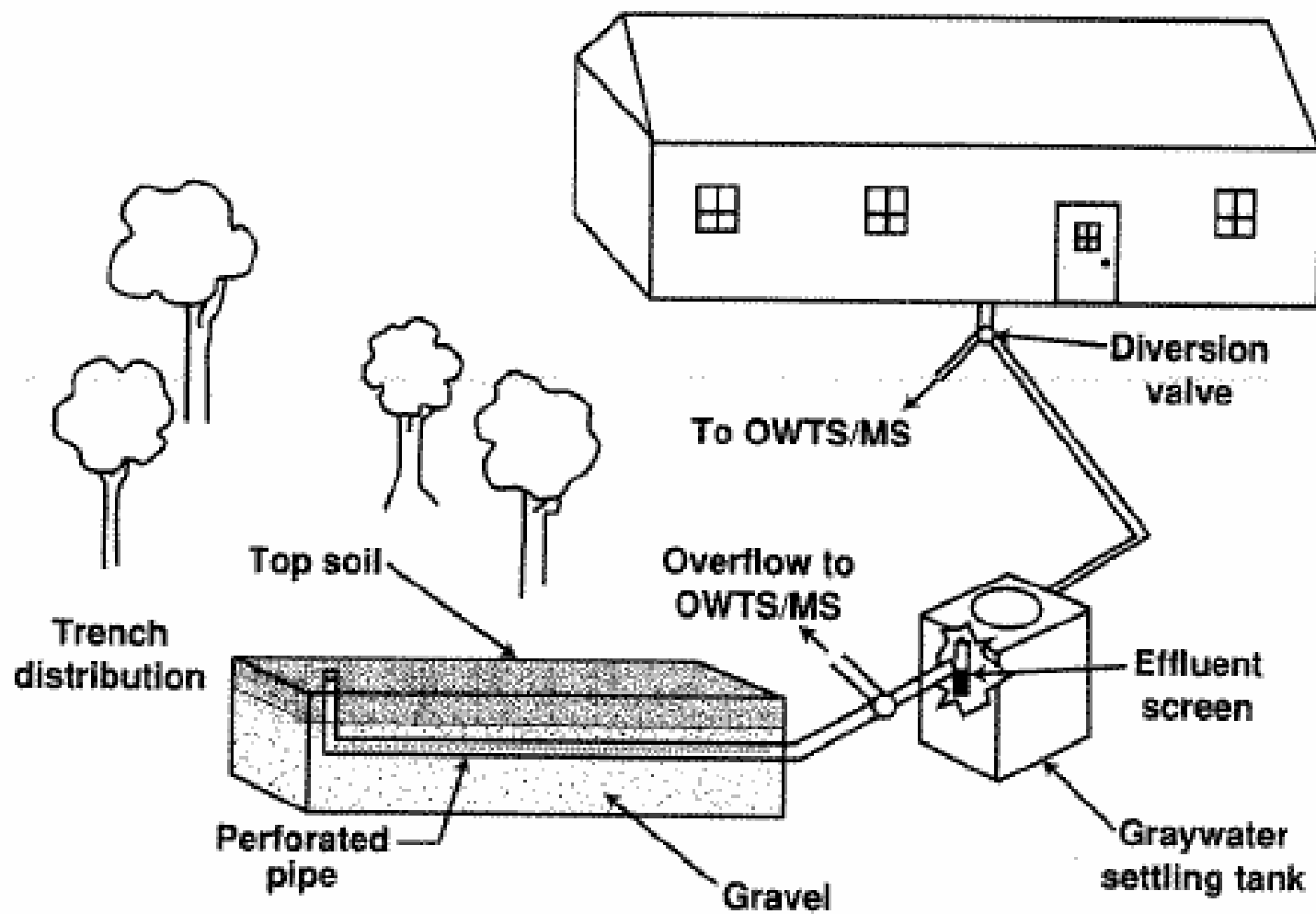


Figure 9. Graywater system with gravity distribution through a gravel media trench.

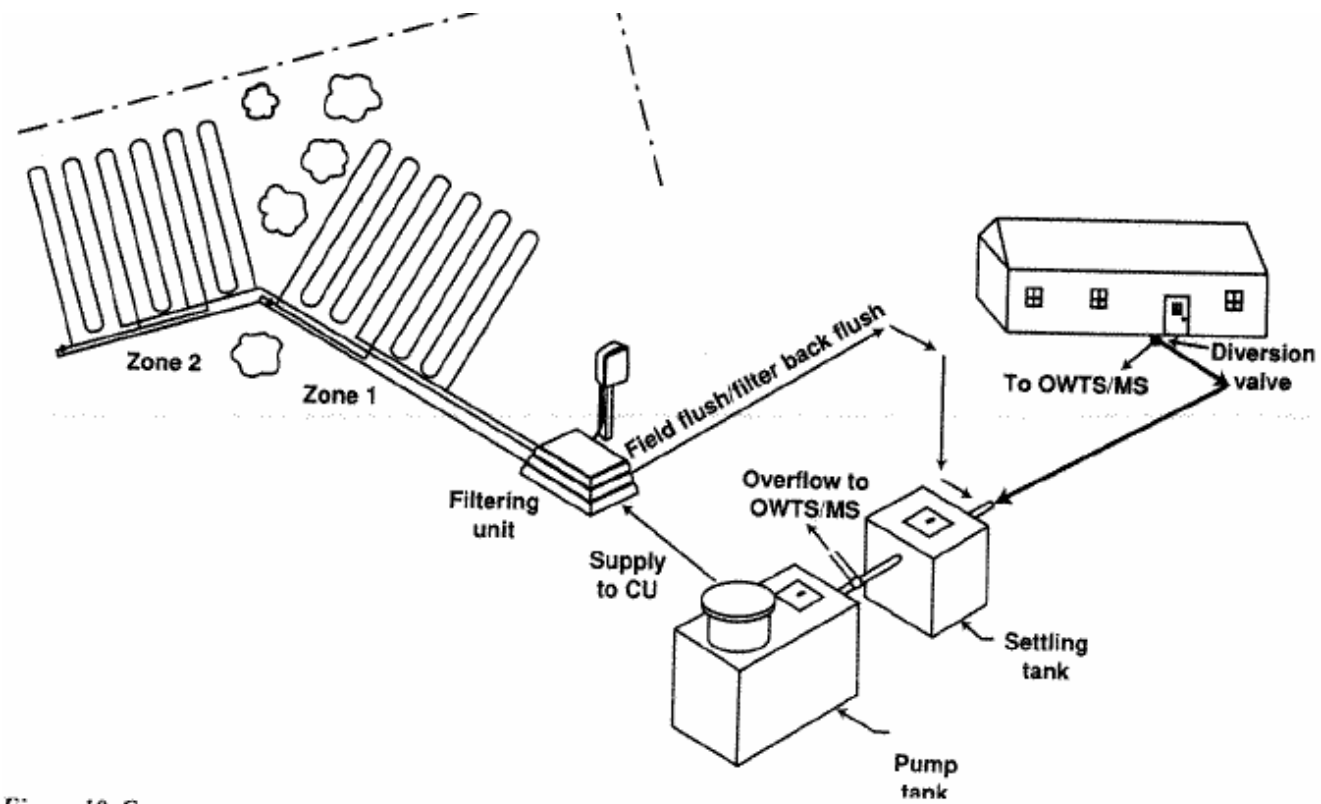


Figure 10. Graywater system using pressurized distribution in a subsurface drip system.

Greywater Recycle

- In-facility Use
 - Use greywater for toilet and urinal flushing
 - Treatment and disinfection
 - Two levels
 - Individual buildings
 - Cluster water reuse system
- Total Recycle/Non-Discharging/Closed Loop
 - No water enters or leaves the system
 - Drawback: potential accumulation of contaminants due to repeated passage of water through the system

Individual Building System

- Collect wastewater from sinks separately
- Each building has its own reclamation system
- Each building has dual plumbing system

Cluster System

- Treat wastewater from block(s)
- Transfer treated (reclaimed) wastewater back to buildings for flushing
- Blocks and buildings have dual plumbing system

Cluster System

Irvine Ranch Water District, CA



Toilet flushing
Cooling water for air conditioners

The Solaire High Rise Building

- Battery Park – New York City
- Urinal/Toilet flushing
- Air conditioning cooling water

Using Graywater

- Advantages
 - Saves water
 - Less discharge – more ecologically sound
- Disadvantages
 - More costly

Another View of the Cycle

