

Water used in homes, schools, businesses, and industries must be cleaned or treated before

Water used in homes, schools, businesses, and industries must be cleaned or treated before it can be used again or returned to the environment. No matter where you live, in a urban or rural setting, the water you use does not just disappear: it is piped to a treatment system. The treatment of wastewater is important to keeping our water clean. This poster depicts what happens to the water we all use and how wastewater is treated so that it can be used again. The poster is folded into 8-1/2 by 11-inch panels; front and back panels can easily be photocopied.

Drawings on the left-hand side of the poster represent the large city (urban and suburban areas) and drawings on the right-hand side of the poster represent small towns and rural areas. In the city, the used water is piped through large underground sewer pipes to a community wastewater facility. At the wastewater-treatment facility, the wastewater is treated by various processes, which include grit chambers, sedimentation tanks, trickling filters, and disinfection. The treated water is the averaged or returned to the environment. A part of the wastewaters solids can reated water is then reused or returned to the environment. A part of the wastewater solids can be used as fertilizer in agriculture or sliviculture and for revegetation of lands disturbed by mining, construction, fire, landslides, or other natural disasters. The remaining solids are disposed of in ntally safe manner

In small towns and rural areas, several alternative and individual onsite collection and treatment processes are used in treating wastewater. This poster depicts several processes, which are: lagoons, wetlands, septic tanks and leach fields, and sand filters.









# Septic Tank

The sentic tank separates solids from liquids. The solids collect on the bottom of the tank and are periodically pumped out and disposed of at a community treatment facility or an approved disposal site. The partially treated wastewater is piped to a leach field.

# **Trickling Filter**

A bed of stones from 0.9 to 1.8 meters deep through which wastewater passes. Micro-organisms, including bacteria, collect on the rocks and consume most of the organic matter in the wastewater. The treated wastewater or effluent may be disinfected by chlorine before being released to the

# Sand Filter

A system used in areas with high water tables, shallow soils, or soils that water cannot flow through easily. Sand and gravel are mounded on top of natural soil to filter wastewater received from the septic tank before the wastewater reaches natural soil

# **Activated Sludge Process**

Wastewater is mixed with air and micro-organisms in an aeration tank, and the micro-organisms break down organic matter. From the aeration tank the wastewater is piped to another sedimentation tank to remove remaining suspended solids. The treated wastewater or effluent may be disinfected by chlorine before being released to the environment. The excess materials are treated as part of the biosolids production process.













# **Wetland**

A naturally occurring filtering system that improves water quality by reducing nutrients while providing wildlife habitat

# Grit Chamber

The initial step for treating raw sewage where heavy materials that might damage equipment or interfere with later processes are removed from raw

# **Sedimentation Tank**

A structure designed to remove suspended solids. The speed of flow is decreased as wastewater moves through this tank, and suspended solids sink to the bottom and are removed.

# Solids Treatment

Wastewater solids are removed from the bottom of tanks and filters after settling. Prior to use or disposal, the biosolids are treated with chemicals of heat to kill disease-causing organisms and decrease the water content.

# Composting

Composting uses biological processes to generate heat to kill disease-causing organisms in the biosolids. By forcing air into the compost pile, more oxygen is available to the biological organisms that decompose the biosolids. The treated biosolids can be used as fertilizer, burned, or placed in a landfill

# Lagoon

A treatment pond, usually 1 to 1.5 meters deep, that use sunlight, algae, micro-organisms, and oxygen to remove organic matter and nutrients from wastewater. The resultant wastewater may be disinfected by chlorine before being reused or released to the environment.

# Leach Field

Wastewater from the septic tank is piped to the leach field or absorption field and seeps through the soil. The soil serves as a filter, removing bacteria and nutrients from the wastewater. The wastewater is purified by the micr organisms that live in the soil

# ACTIVITY **AUDITING YOUR WATER USE**

# INTRODUCTION

Water conservation is important for several reasons. The more water we conserve, the more we have for other uses and the less money we need to spend on treatment and treatment facilities. The following survey is designed to increase your students' awareness of the water they use, to reveal how water is wasted, and to encourage water

#### OBJECTIVES

- 1. Identify the ways we use water.
- 2 Identify ways the students and their families can conserve water.

#### MATERIALS REQUIRED

- 1. Copy of the "Auditing Water Use" worksheet for each student.
- 2. Two-liter soft drink container for each student. Have the students bring containers from home.

- 1. Make one copy of the "Auditing Water Use" worksheet for each student in your class.
- 2. Cut off the spout of a 2-liter soft drink container. This will make it easier to measure the flow of water.

#### PROCEDURE

Give each student a copy of the "Auditing Water Use" worksheet and a 2-liter container to take home. Explain to the students that they are going to determine how each of them uses water and how much water they use. As each student completes the survey, ask them to think about ways that water can be used more efficiently in the

# INTERPRETIVE QUESTIONS

After the students have completed the worksheet, list the total daily use from each student on the blackboard. Add these total daily uses together to determine total daily water use by the class. Use the following questions for

- 1. In which category is the most water used? Compare the water uses to the pie chart in the **DEFINITIONS** panel.
- 2. Discuss ways to decrease water use. Examples:
- a. Spend less time in the shower
- b. Take a shower instead of a bath.
  c. Only flush the tollet when necessary: use waste container for tissue trash and paper towels.
  d. Run the clothes washer and dishwasher with full loads.
  e. Turn off the water while br

- 3. Ask each student to determine an improved daily use of water by applying the water-saving suggestions discussed previously. Determine a second class total based upon the savings. Compare total

#### **EXTENSION**

Determine what it costs in dollars to treat water for drinking purposes and for wastewater disposal. This cost can be determined by contacting the water-supply and wastewater-treatment facilities in your area. Use these values to estimate the potential savings in dollars for the class if water-conservation methods were to be implemented. Multiply this dollar savings by the number of classes in the school. How much money could be saved if water-conservation methods were practiced by everyone at school?

### **INVESTIGATION PANELS**

The following investigation panels are designed to examine the wastewater-treatment process or processes utilized in your community. Make one copy of the appropriate investigation panel for each student in your class. Students may want to ask their parents to assist them with some of the questi

If the wastewater from your school is piped to a community treatment facility, complete the following:

a. What stages and process or processes of treatment does wastewater go through?

- 1. Where is the wastewater-treatment facility?
- 2. Discover some facts about your wastewater-treatment system.

otages. primary seconds	advanced	
Processes: activated sludge	trickling filter	
lagoon	other	
b. What is the treatment capacity of the waster	water-treatment facility that serves your house?	
million liters per day.		
c. How are biosolids being reused or disposed?		
burned	landfill	
used as fertilizer	other	
d. Where does the treated effluent go after it is	piped from the facility?	

Adapted from Virginia Water Resource Center "Be Water-Wise."

# SEPTIC TANK SYSTEMS

river or stream

ocean

reuse

If the wastewater from your home is piped to a septic tank, complete the following:

1. Draw a map of your home and yard on the back of this worksheet or on a separate sheet of paper and mark the location of the septic tank and leach field.

other

- 2. How many liters of sewage and wastewater does your septic tank hold? \_\_\_\_\_ liters
- 3. Has the septic tank ever worked improperly? No \_\_\_\_\_\_ Yes \_\_\_\_\_
- 4. When was the last time your septic tank was pumped?
- 5. Where was the pumped waste disposed?

landfill	trea	atment facility
lagoons	othe	er

Adapted from Virginia Water Resource Center "Be Water-Wise."

### **AUDITING WATER USE**

A 1	2~	åb.	

	1.	Volume of water used (circle one); (use answer in A3 below.) 1/3 of tub = $57$ liters 1/2 of tub = $76$ liters 2/3 of tub = $106$ liters
	2.	Number of baths taken daily: per day. (Use answer in A3 below.)
	3.	Daily water usage for bathtub: A1 × A2 = per day
в.	To	ilet
	1.	Liters per flush:iliters. (use answer in B3 below.) If you know your fixture is a low-volume model, enter 13 liters. If you do not have a low-volume model, enter 26 liters.
	2.	Count the number of times you flush the toilet a day: per day. (Use answer in B3 below.)
	3.	Daily water usage from toilet: B1 × B2 = liters per day
C.	Sh	<u>ower</u>
	1.	Average length of shower: minutes. (Use answer in C3 below.)
	2.	Flow rate of water used in shower: liters per minute. (Use answer in C3 below.) To measure rate of the water:
		<ul><li>a. Adjust the shower's water flow as you would normally.</li><li>b. Record the time it takes to fill a 2-liter bottle with water. Convert the measurements to liters per mini</li></ul>
		Example: liters per minute = $\frac{60  \text{seconds}}{1  \text{minute}} \times \frac{2  \text{liters}}{\text{time to fill 2-liter bottle in seconds}}$
	4.	Average shower water, use C1 $\times$ C2 = liters. (Use answer in C5 below.)  Number of showers taken daily: per day. (Use answer in C5 below.)  Daily water use for showers C3 $\times$ C4 = liters per day.

#### D. Faucet

 Use the procedure described in the "Shower" section to measure your flow of water from faucets in liters per minute. (Use answer in D3 below.)

2.	Determine the	time you spend running water during the day for the following:
	Toothbrushing.	minutes per day
	Drinking _	minutes per day
	TOTAL	minutes per day (Use answer in D3 below.)

3. Daily water use from faucet: D1 × D2 (total) = \_\_\_\_\_

- Loads done for your whole family each week: \_\_\_\_\_ loads per weel
   E1 divided by 7 = \_\_\_\_ loads per day. (Use answer in E3 below.)
   Daily water used for dishwashing: E2 × 60 liters per load = \_\_\_\_\_ lit

## F. Clothes Washer

1. Loads done for your whole family each week:
2. F1 divided by 7 = \_\_\_\_ loads per day. (Use answer in F3 below.)
3. Daily water used for clothes washing: = F2 × 114 liters per load = \_\_\_\_ liters per day.

TOTAL DAILY WATER USE = \_\_\_\_ liters per day. (Add the liters per day values from each category.)

Adapted from South Florida Water Management District, "Auditing Your Water Use."

# **DEFINITIONS**

Advanced treatment—A level of treatment that removes additional contaminants that have not been removed by

\*Biosolids—Primarily an organic solid product produced by wastewater-treatment processes that can be

Fffluent—Water that flows from a treatment facility after the wastewater has been treated.

Micro-organisms—Small living organisms, including bacteria. Some species consume the organic part of

Primary treatment—The first stage of the wastewater-treatment process at the facility in which mechanical procedures are used to remove pollutants.

Reclaimed water-Effluent that is used for irrigation or other purposes.

Secondary treatment—The second stage in wastewater treatment in which micro-organisms consume the organic parts of the waste.

Sewer—A system of underground pipes that collect and deliver wastewater to treatment facilities

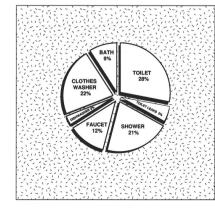
Suspended solids—Undissolved waste particles carried by the water.

Wastewater-Water that has been used in homes, schools, businesses, and industries and is not suitable for

Wastewater treatment facility—A structure with a series of tanks, screens, filters, and other processes used to clean wastewater before it is returned to the environment.

"For the purposes of this poster we have incorporated the term biosolids as defined in the publication "A Plain English Guide to the EPA Part 503 Biosolids Rule": U.S. Environmental Protection Agency, Office of Wastewater Management, EPA/832/P-93-003, September, 1994.

# WHERE YOU USE WATER IN YOUR HOME

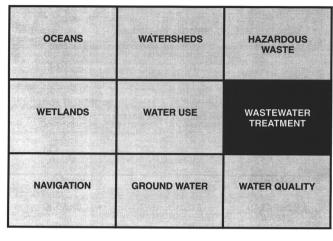


Average indoor home use of water in the United States is approximately 300 liters per person per day. Approximately 75 percen utilized in the bathroom. (See Pie

### Poster Series

This poster is part of a series of water-resources education posters developed through the U.S. Geological Survey's Water Resources Education Initiative, a cooperative effort between public and private education interests. Partners in the program include the U.S. Geological Survey, Bureau of Reclamation, and the U.S. Fish and Wildlife Service of the U.S. Department of the Interior; the National Oceanic and Atmospheric Administration; the U.S. Environmental Protection Agency; the U.S. Army Corps of Engineers; the Nebraska Groundwater Foundation, and the National Science Teachers Association

The other posters in the series are entitled "Oceans--Coastal Hazards: Hurricanes, Tsunamis, Coastal Erosion", 
"Watersheds: Where We Live", "Hazardous Waste: Cleanup and Prevention", "Wetlands: Water, Wildlife, Plants, & 
Peoplell", "Water: The Resource That Gets Used & Used & Used for Everything!", "Navigation: Traveling the Water 
Highways!", "Ground Water: The Hidden Resource!", and "Water Quality...Potential Sources of Pollution". The 
posters in the series are designed to be joined to create a large wall mural. A schematic of the wall mural is displayed 
on this panel. The gray shaded spaces represent the posters listed above. The black shaded space represents



Water-resources topics of the posters are drawn in a cartoon format by the same artist. All poster are available in color. The reverse sides of the color posters contain educational activities: one version for children in grades 3-5 and the other for children in grades 6-8.

# **ORDERING INFORMATION**

Copies of all the posters in the series (see Poster Series Panel) can be obtained at no cost from the U.S. Geological Survey. Write to the address below and specify the poster title(s) listed on the Poster Series panel, and grade level(s) desired. The poster "Water: The Resource That Gets Used & Used & Used for Everything!" is also available in black-and-white, intended for coloring by children in grades K-2. In addition, the poster "Water: The Resource That Gets Used & Used & Used for Everything!" with activities intended for grades 3-5 is available in Spanish. There is a minimum shipping charge of \$20.00 or actual cost if greater and \$3.50 handling charge (total \$23.50 in U.S. dollars) applying to ALL orders shipped to locations that are not a U.S. State or Territory.

> U.S. Geological Survey Branch of Information Services Box 25286 Denver Federal Center Denver, CO 80225 Telephone: 1-888-ASK-USGS

# **ACKNOWLEDGMENTS**

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### Washington, D.C. **U.S. ENVIRONMENTAL PROTECTION AGENCY**

The mission of the U.S. Environmental Protection Agency (EPA) is to improve and preserve the quality of the environment, nationally and globally. The EPA works to protect human health and the natural resources on which all human activity depends. In response to growing public concern over health and environmental risks posed by hazardous waste sites, Congress established the Superfund program in 1980 to clean up these sites. The EPA, in cooperation with States and Tribal governments, locates, investigates, and cleans up hazardous waste sites throughout the United States. Superfund's main goal is to protect human health and the environment. It is funded mainly but was elegated on the obscious age textsolum indivision. by taxes placed on the chemical and petroleum industries.

# **U.S. GEOLOGICAL SURVEY**

As the Nation's largest water, earth, and biological science and civilian mapping agency, the USGS works in cooperation with more than 2,000 organizations across the country to provide reliable, impartial, scientific information to resource managers, planners, and other customers. This information is gathered in every state by USGS scientists to minimize the loss of life and property from natural disasters, to contribute to the conservation and the sound economic and physical development of the Nation's natural resources, and to enhance the quality of life by monitoring water, biological, energy, and mineral resources.

U.S. Department of the Interior

U.S. Geological Survey

MIDDLE SCHOOL