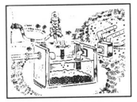
How Do We Treat Our Wastewater?
Peck's Apartments
Cohen's Pizza
Lane's Laundromat
Shopping Mall
Garage
Reclaimed Water
Wastewater Treatment Administration
Activated Sludge Process
Chlorine Tank
Grit Chamber
Secondary Aeration Tank
Primary Sedimentation Tank
Secondary Sedimentation Tank
Solids Treatment
Outfall
Wetland
Lagoon
Lodge Trailer Park
Septic Tank
Sand Filter
Leach Field
Biosolids Truck
Biosolids for Fertilization
Composting
Air
Trickling Filters
Chlorine Tank
Secondary Sedimentation Tank
Solids Treatment
Outfall
Pretreatment Plant
Wentz Corp.
Bank
The Year of Clean Water
School
Septic Tank
Leach Field
Water Table
Aquifer
USGS
science for a changing world
Grade School

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 an 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.

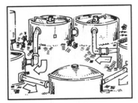
Drawings on the left-hand side of the poster represent the large city (urban and suburban areas) and drawings on the right-hand side of the poster represent small towns and rural areas. In the city, the used water is piped through large underground sewer pipes to a community wastewater facility. At the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



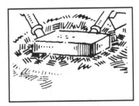
Septic Tank

The septic 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 environment.



Sand Filter

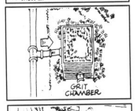
A system used in areas with high water tables, shallow soils, or soils that water cannot flow through easily. Sand and gravel are mounded on top of natural soil to filter wastewater received from the septic tank before the wastewater reaches natural soil.

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 sewage.

Sedimentation Tank

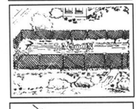
A structure designed to remove suspended solids. The speed of flow is decreased as wastewater moves through this tank, and suspended solids sink to the bottom and are removed.

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 or 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 micro-organisms that live in the soil.

WHERE DOES YOUR USED WATER GO?

INTRODUCTION

Students and their parents should know how wastewater gets to a treatment facility, and what type of treatment the wastewater receives there. The following activity and investigation panel are designed to examine how used water gets to a treatment facility and the treatment process or processes utilized in your community. Do the activity first, then ask the students to answer the questions addressed by the investigation panel.

ACTIVITY

OBJECTIVE

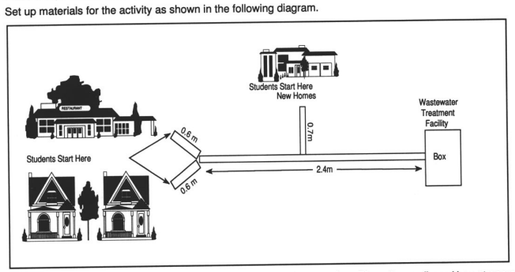
To demonstrate what happens to wastewater and the importance of treatment facilities to a community.

MATERIALS REQUIRED

1. One piece of wood, rope, or a strip of paper, approximately 2.4 meters long.
2. Two pieces of wood, rope, or strips of paper approximately 0.6 meter long.
3. One piece of wood, rope, or strip of paper approximately 0.7 meter long.
4. Shredded newspaper.
5. Cardboard box, any size.

TEACHER PREPARATION

1. Place a copy of this poster on the wall where the students can see it.
2. Set up materials for the activity as shown in the following diagram.



The 2.4-meters-long object represents the main underground sewer pipe. Place the cardboard box at one end of the "main sewer pipe," place two 0.6-meter-long objects to represent underground pipes coming from buildings where water is being used (homes, schools, restaurants, factories). Place the 0.7-meter-long object perpendicular to the middle of the "main sewer pipe." This object represents underground pipes coming from homes recently constructed in the community.

INVESTIGATION PANEL

This investigation panel is designed to examine the wastewater-treatment process or processes utilized in your community. Make one copy of this panel for each student in your class. The questions that address the disposal of wastewater from the school can be assigned as a class project and answered by contacting the local wastewater-treatment facility. The questions that address septic tanks apply only to students whose homes utilize this type of wastewater-treatment process. These questions can be answered at home with assistance from the students' parents.

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

1. Where is the wastewater-treatment facility?
2. Discover some facts about your wastewater-treatment system.
   a. What process of treatment does the wastewater-treatment facility use?
      trickling filter _____ activated sludge _____
      lagoon _____ other _____
   b. What is the treatment capacity? _____ million liters per day.
   c. How are biosolids being reused or disposed?
      used as fertilizer _____ landfill _____
      burned _____ other _____
   d. Where does the treated wastewater go after it leaves the facility?
      river or stream _____ lake _____
      ocean _____ other _____
      reuse _____

SEPTIC TANK SYSTEMS

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.
2. Has the septic tank ever worked improperly? No _____ Yes _____
   What was the problem?
3. When was the last time your septic tank was pumped?
4. Where was the pumped waste disposed?
   landfill _____ treatment facility _____
   lagoons _____ other _____

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

PROCEDURE

1. Begin with a general discussion about the importance of treating wastewater. Using the poster, trace the flow of "wastewater" from several "buildings" to the "treatment facility." Explain how wastewater travels from houses, schools, and businesses through underground sewer pipes to a wastewater-treatment facility. Once at the "treatment facility" on the poster, discuss some of the processes used to treat wastewater. The pictures and description of the various treatment processes, located on adjacent panels, provide background information.

2. Explain to the students that they are going to pretend to be wastewater. Ask two students to take a handful of shredded newspaper (representing sewage waste). Place one student at the end of each 0.6-meter-long object (total of two students). Explain that the number of students represents the size of the community today. You, the teacher, then should say "flush," signaling the students to walk along the "pipes" towards the "treatment facility." Upon reaching the "treatment facility," the students must count to three, which represents the time taken to treat the wastewater, and throw the newspaper into the "treatment facility."

3. Next ask six students to volunteer. Ask two students to stand at the end of each 0.6-meter long object and two students to stand at the end of the 0.7-meter-long object. Explain that the increased number of students represents the concept that the community has expanded. Send two students per "flush" signal toward the "treatment facility." Give signals in quick succession. When the students become crowded at the "treatment facility" because of treatment time (three seconds), ask the students to wait their turns before throwing the newspaper into the "treatment facility."

INTERPRETIVE QUESTIONS

Use the following questions for discussion:

1. What caused the crowding at the "treatment facility"?

   Answer: Too much "wastewater" to treat at one time.

2. What problems could be caused by the backup of wastewater?

   Answer: Delays in treatment, restrictions on water use, prevention of community expansion.

3. What can each student do to prevent backup at treatment facilities?

   Answer: Conserve water. For example, only flush the toilet when necessary. Use waste containers for tissue trash and paper towels. Turn water off when brushing teeth.

4. What can the community do?

   Answer: Conserve water. Increase the size of the treatment facility.

This activity was adapted from the Massachusetts Water Resources Authority, "Water Wizards."

DEFINITIONS

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

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

Effluent—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 sewage.

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.

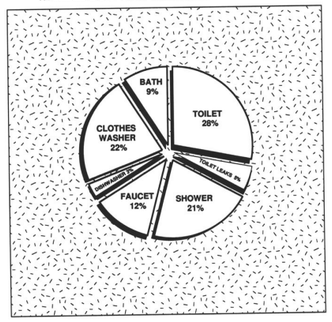
Suspended solids—Undissolved waste particles carried by the water.

Wastewater—Water that has been used in homes, schools, businesses, and industries that is not suitable for reuse prior to treatment.

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/R-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 percent of the water used in the home is utilized in the bathroom. (See Pie Chart.)

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, & People!", "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 this poster.

OCEANS	WATERSHEDS	HAZARDOUS WASTE
WETLANDS	WATER USE	WASTEWATER TREATMENT
NAVIGATION	GROUND WATER	WATER QUALITY

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.

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ACKNOWLEDGMENTS

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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 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

GRADE SCHOOL