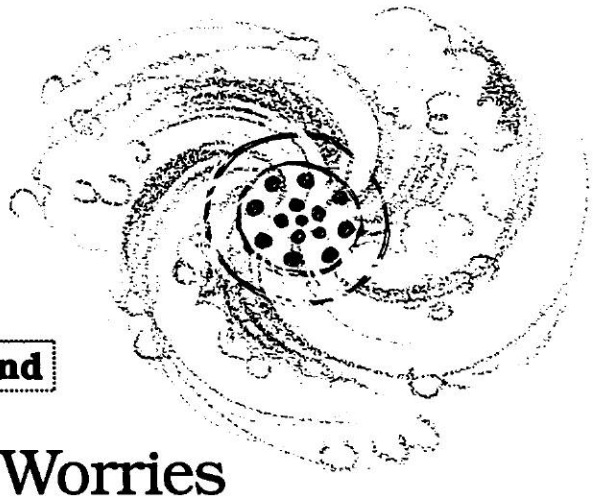


Teacher Background

Wastewater Worries

We used to think we could flush our troubles away. More recently we have come to understand that "down the drain" may spell trouble for animals and plants depending on the waters of the Puget Sound watershed. Sewer outfalls and home septic systems discharge millions of gallons of treated water to Puget Sound and its watersheds every day. Hazardous substances that are not removed in the water treatment process can linger in our waterways to cause a host of problems.

In some areas of the Sound, elevated levels of bacteria and toxic materials have contaminated bottom sediments by binding to fine mud particles. Animals living in the bottom muds and shellfish filtering the water for food may ingest these substances and concentrate them in their tissues. These may seem like sad, unimportant facts until we recognize that the worms, shellfish, and other bottom dwelling animals are part of a food web that may lead right to our own dinner plates.

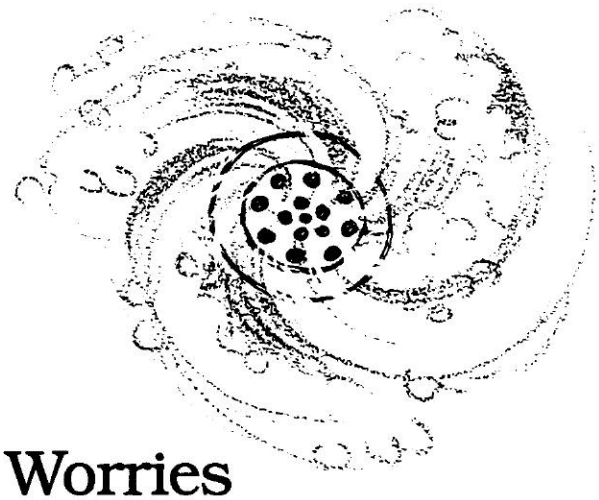
Proper wastewater treatment, therefore, is very important. WASTEWATER WORRIES will introduce your students to the operation of a septic system. Because you may want to add information about urban treatment systems, information is included here on primary and secondary wastewater treatment.

Primary Treatment removes most of the floating and settleable solids by passing the wastes through grates, screens, skimmers and settling tanks. Little more than half of the materials suspended in sewage can be removed through primary treatment. Primary effluent is usually treated with chlorine to reduce the risk of disease organisms being released into the environmment. Around Puget Sound all primary treatment facilities are being replaced with secondary treatment plants during the comining decade, but in many communities they are still in service.

Secondary Treatment removes waste materials biologically. Oxygenation and enhanced growing conditions are provided for bacteria and other organisms which break down dissolved organic materials present in wastewater. Secondary treatment also removes 85-90% of suspended solids and eliminates almost all disease bacteria.

As stated in the student section, septic systems are used in residences which don't have access to municipal treatment facilities. Because maintenance of a septic system is so critical, householders have a major influence on whether their system is environmentally safe or whether it is contributing to serious water quality problems which are now plaguing parts of the Puget Sound watershed.

For further information on primary treatment, secondary treatment and septic septic systems, ask at your county health department. Your health department will also be a source of information on the status of wastewater treatment in your area.



Lesson Plan

Wastewater Worries

Student Objectives

- A fictional tour through a septic system introduces the basic mechanics of this wastewater treatment system. Students suggest maintenance practices which will help a septic system function properly.

Materials

- One copy per student: WASTEWATER WORRIES

Answer Key

1. Cow manure contains fecal coliform bacteria. If the river runs through the pasture or frequently floods the pasture, bacteria can be washed into the water. Heavy rains often carry bacteria longer distances, causing higher than normal coliform levels in adjacent bodies of water.

2. E. coli is a convenient indicator that fecal material is present in the environment. Its presence is a signal that dangerous pathogens may also be present.

3. Sinks, dishwashers, showers, washing machines, garbage disposals and toilets are all sources of wastewater.

4. Common items disposed of down the drain include soaps and detergent, cosmetics, household cleansers, food scraps, sewage, toilet paper, tampons and tampon applicators, etc, and occasionally grease, paper towels, disposable diapers, and paints and solvents. Probably every student can remember something inappropriate going down the drain by mistake.

5. Non-biodegradable items include plastics (eg. paper diapers, tampon applicators), paints, glass, and certain chemicals and detergents.

6. Chlorine bleach, toxic chemicals, pesticides, paint thinners and solvents are all destructive to the bacteria that make a septic system work.

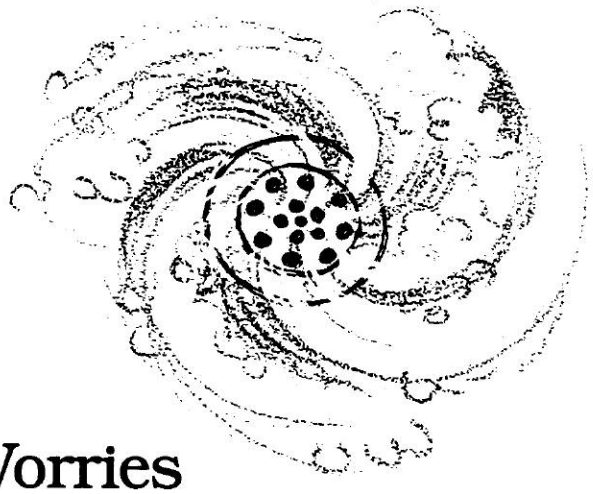
7. If water doesn't discharge through a drainfield as rapidly as wastewater enters the septic tank, a backup will result somewhere else in the system, eg. over the septic tank or possibly inside the house. This will usually get the residents' attention.

8. If the drainfield is laid in soil which is too porous, the wastewater will pass through it too rapidly and will not be adequately filtered before it comes in contact with ground water or nearby rivers.

9. All efforts to conserve household water use will limit the volume of water passing through the septic system. In addition, residents can check to see that roof drains and stormwater runoff are not passing into the septic system. Distributing laundry chores or other activities which use large amounts of water throughout the week may also be helpful.

10. Possible additions to the septic system suggestions list:

- Don't put substances in your septic system which won't biodegrade and might clog up pipes or drain tiles (any substances mentioned in #5, above)
- Don't put materials which are toxic to septic tank bacteria down the drain (any substances mentioned in #6, above)
- Students may also make suggestions about proper design and placement of the drainfield.



Wastewater Worries

"Yes," said the health department biologist, *"I'm afraid our fecal coliform tests are coming up positive along this section of the stream."*

These words meant nothing to Hyak, hovering quietly in the shadows of an overhanging tree, but they did warn of possible water quality problems along this section of the river.

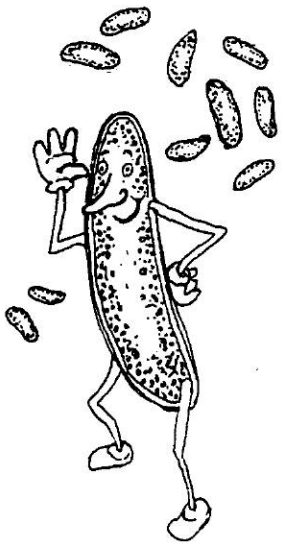
What the biologist meant to say was that certain bacteria known as fecal coliforms were present in this water, bacteria that are known to live only in the intestines of humans or other warm blooded animals. A positive test usually indicates that fecal matter (excrement) of humans or other animals is present in the environment.

"It may be coming off those pastures where cattle are grazing," the biologist explained to her assistant. *"But I'm concerned that some septic systems from homes in this area are not functioning properly."*

1. Why might the cow pasture be a possible source of fecal coliform bacteria in the water?

The biologist also suggested that bacteria from human wastes may have found their way into the river. Let's find out this could happen.

To do this we need to take a tour through a septic system. A septic system is a system for treating wastewater from a home which is not connected to an urban sewer. About one fourth of all homes in the Puget Sound area use septic systems to treat their wastewater. When properly designed and maintained, a septic system causes virtually no contamination of the environment, but malfunctioning systems can cause serious health problems to people and wildlife.



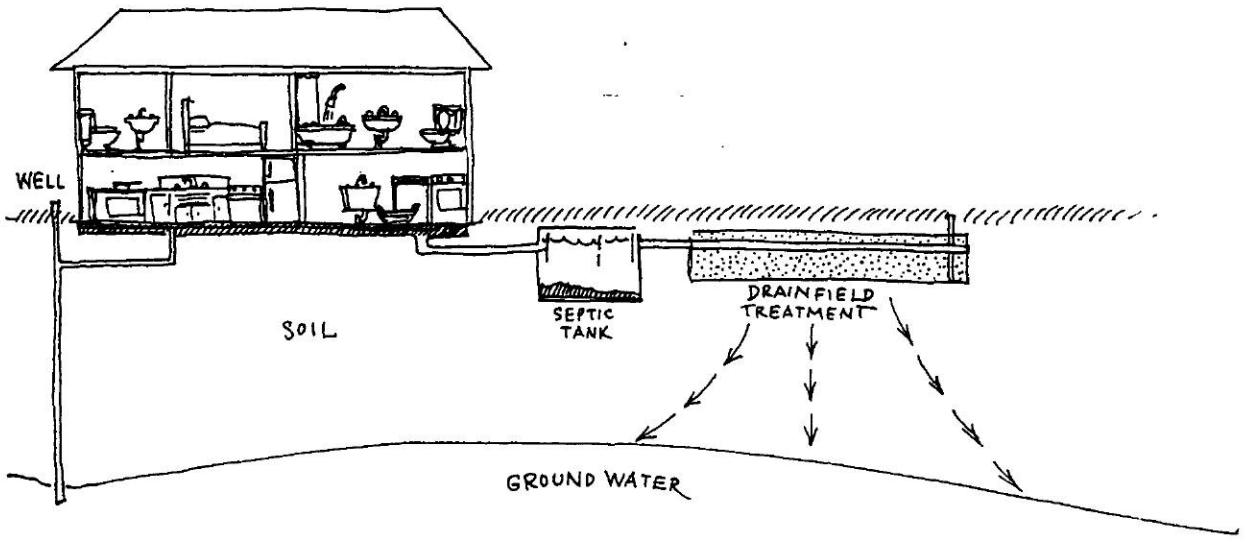
Before we start the tour, let's meet our guide. His name is E. coli, and he is a tiny bacterium who lives in the lower intestine of all warm-blooded animals, including yours. He's not a bad little bacterium. He doesn't make you sick or cause you any trouble like certain other microbes do which are carried the same way, the microbes which cause dysentery, hepatitis, and typhoid fever for example. We know a lot about E. coli because he's easy to grow in a lab and easy to test for in the environment. We often test for him to learn if human wastes are escaping our treatment systems, because it could mean that dangerous bacteria are present as well. E. coli are sometimes refered to as fecal coliforms.

2. If E. coli isn't harmful to humans, why does the health department test for it in the environment?

Let's get going! Now if you'll just step up to the kitchen sink we'll begin shrinking ourselves down to the size of a water drop so we can slide down the drain. There--we're off!

Our guide, E.C. is waiting in the junction pipe leading from the bathroom. He leads the way into the main sewer line which drains all the water used in the household.

3. Use the diagram to find at least six places in the house where wastewater is generated.



4. Eventually the water treated by our septic system will be discharged back onto the environment near the home. What are some things that often go down the drain in a typical household that you would hope a septic system could remove?

As we move away from the house through the sewer pipe, E.C. explains that septic systems have two important parts -- a septic tank and a drain field into the soil. The waste water first enters the septic tank, a large container of about 1,000 gallons where heavy solids can settle out on the bottom and lighter solids can rise, forming a scum layer on the surface. Gradually over time, the solids biodegrade (break down by bacterial action) leaving only nondegradable deposits behind.

5. What are some materials which might not biodegrade in a septic tank?

6. What household substances, if poured down a drain, might harm the bacteria that do the important work in a septic tank?

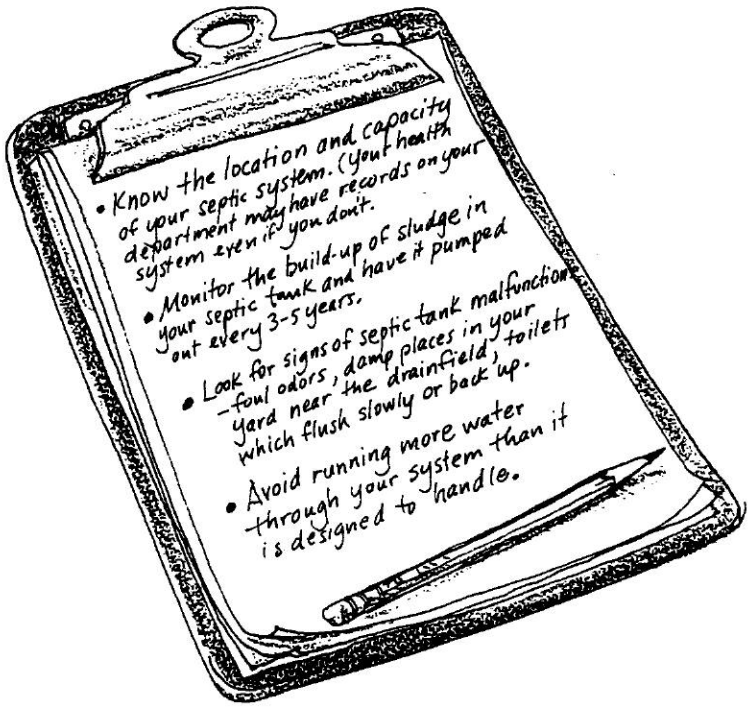
Leaving the settling chamber of the septic tank behind, we duck under the scum baffle to find our way into the liquid outlet chamber. Now we are on our way to the the second important part of a septic system, the drainfield. The drainfield is a system of perforated pipes which release the wastewater into an area of soil. Slow movement through the soil will filter harmful materials from the water, and soil bacteria will further decompose suspended solids. By the time it reaches the nearest well or waterway, the water will be free of bacteria and dangerous substances. In order to work properly, however, the drainfield must be placed in suitable soil and the pores in the drainage tiles must not be clogged.

7. What might happen to the system if the pores in the tiles become clogged, or if if the soil cannot absorb the liquid as fast as wastewater enters the septic tank?

8. On the other hand, some soils are very sandy and porous. How might a drainfield laid in such a soil contribute to contamination of ground or surface water?

We can see that our guide has become securely lodged in a particle of soil in the drainfield, so we thank him kindly for the tour and dig our way to the surface, expanding to our full size as we emerge.

As you shake the grass from your hair, you notice the health department biologist and her assistant walking toward you. They are making a list of things people can do to keep their septic systems in good order, to protect watersheds from human waste. They have already written several things on their list:



9. How could someone reduce the volume of water they run through their septic system?

10. Add at least two more suggestions to the biologists' list.

(Hint: What substances should probably not be put through a septic system?)