Flush the Kids

Activity Description
Students learn about how a septic system works, and what the components of wastewater are from household use. Students learn how some of the components are treated or filtered out by the septic system and how others, such as nutrients from human waste, pass through the system untreated, enter the groundwater and ultimately are a major contributor to coastal pollution.

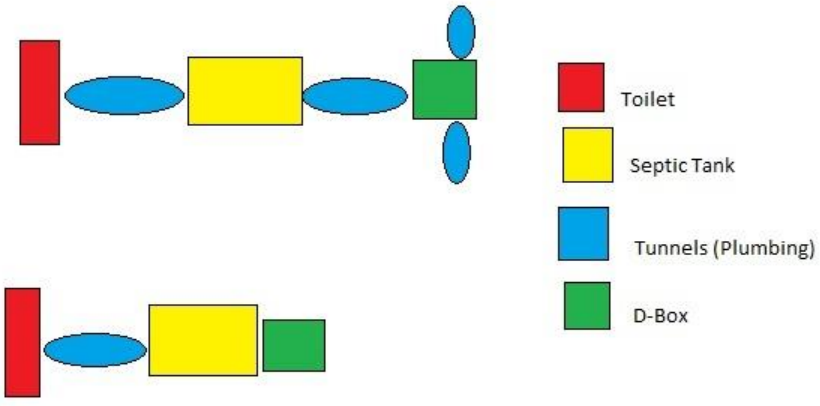
Take Home Message
Septic Systems are effective at disposing of wastewater, but do not remove all contaminants, and are responsible for adding nutrients to ground and surface water that eventually will cause water quality problems. *Previous AmeriCorps members say they pretty much just focused on Nitrogen.*

Massachusetts Frameworks
Technology/ Engineering

Design, Produce and Use #2

Supplies
- Septic System Model- giant toilet, PVC pipes and cloth covers for septic tank and d-box, tunnels, fabric pockets for bacteria and phosphorous, bag for grease
- Wastewater Component Cards- Nitrogen, Phosphorous, Bacteria, Solids & Grease.

Set-Up
1. Build PVC boxes and cover with cloth covers.
2. Unfold 3 or 4 of the tunnels, depending on how much room you have and whether or not you are going to use the d-box. If space is limited, set up one or two runs between the toilet and the septic tank, and attach the d-box to the tank. If you have enough space, you can have one pipe extend out of the septic tank to the d-box, and then another two runs extending out from either side of the D-box. (See diagrams below)
3. Pin up the pockets for the cards as follows: Solids is at the bottom of the septic tank (pockets are sewn on panel), Bacteria can go anywhere in the tank, Phosphorus is in the D-box. Grease will "float" on top of the blue netting…sort of drape it over the roof pole and pin to two corners.
4. Organize wastewater component cards.

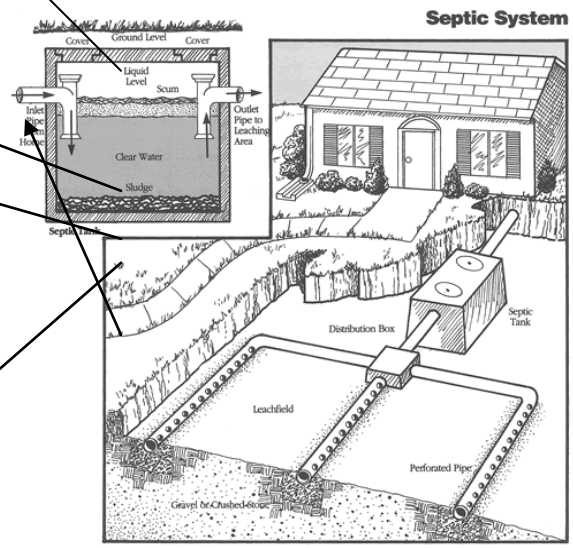


Septic Systems

Septic systems are one reason it is hard to keep the water in the aquifer as clean as we would like. On Cape Cod most homes have a **septic system** instead of a connection to a sewer system. With a septic system, wastewater from the home goes into a tank in the ground and is broken down by bacteria through a natural process. Although these systems work well to remove pathogens and recycle most of the components of wastewater, they do not remove excess nutrients.

The Title V septic system works as a series of steps. The wastewater in the septic system is separated based on density differences. The sludge settles to the bottom, less dense materials such as fats and oils rise to the top, and the remaining wastewater stays in the middle, where bacteria break up many of the compounds. This water flows through a pipe to the distribution box and then out into the ground through a series of perforated pipes called the leaching field.

When the water slowly drips out of the pipes, it gets filtered by the sand and gravel underground, which removes bacteria and some viruses. After a few years the sludge from the bottom of a septic tank will have built up and will need to be pumped. If it is not removed, the sludge can build up so far that it flows out into the leach field and will clog it. The system will back up onto the lawn, or even into the house.



Individual on-site septic systems have been used historically on Cape Cod. This was a viable wastewater solution for an area with a relatively small and spread out population. As the population has grown, more water is withdrawn from the aquifer, and the water returned to the aquifer is increasingly polluted.

Activity Procedure/ Script

First kids learn about what a septic system does: (*Previous AmeriCorps members say they often had to trim the content of this section because the kids had so many questions or didn't understand certain concepts.)*

- **Does any one know what happens to the water when you flush your toilet?**
  - Show them the toilet that is connected to a septic system, where all of the wastewater in your house goes. Wastewater was once nice clean water, but by doing all of the jobs around the house it has picked up some rather nasty extra features.
- **What are some of the other sources of wastewater besides the toilet?**
  - Shower, sink, dishwasher, washing machine.
  - Point out to the students that along with the clean water that goes down the drain, wastewater is full of other things, some good and some bad. Talk about the constituents that are represented by the cards and where they come from, grease from cooking oils, solids from dirt and poop, also toilet paper, bacteria from our intestines, nitrogen from our urine, and phosphorus from detergent. *Previous AmeriCorps members have said that these distinctions (where the bacteria, nitrogen, and phosphorus come from) are too much and are unnecessary.*
- **Now let's see what happens when the wastewater goes into the septic system – the system is sort of like an underground chemical factory, where wastewater gets reorganized.**
  - Begin by using the side of the display on the model to explain how a septic system works.
  - Bacteria are like the factory workers, they are very necessary to make the septic system work. Bacteria break down the solids at the bottom of the tank, and stabilize the nutrients so they can be used again by other living things.
  - The liquid waste, which contains the nutrients, nitrogen and phosphorous flows out of the tank and into the distribution box.
  - Bacteria are here too.

- The liquid leaves the d-box and leaks out into the soil in the leaching tunnels. **Phosphorous is trapped on the soil particles** and the **nitrogen keeps moving through the soil and travels along with the groundwater.**
  Some bacteria are trapped in the leaching field as well, and keep working to make the wastewater components less toxic.

- **But as hard as the bacteria has tried it's not able to do it all, and not all of the contaminants in wastewater are removed by the septic system.**
  - The nitrogen keeps moving through the system, and into the groundwater, it eventually enters the coastal waters, and causes the algae to grow more rapidly. This results in poor water quality and can harm aquatic life.
  - This is also a great place to talk about algae blooms in ponds, since that relates to so many of the other booths.

Now they will get to be "Flushed!"

- **Tell the students "Now, you're going to be the toilet water!"**

Hand out the cards to the students (every student gets 1 of each).

- **Tell them their job is to enter the septic system, and using the knowledge that they have just learned, to figure out where each of the components are supposed to be deposited, so that the wastewater can be cleaned up. They should look for the labeled pockets to put their contaminant cards in.**
  - Each student will now enter the septic system. Flush them one at a time.
  - 4th and 5th grade can be told that they will have one card leftover. 6th grade can be left to figure it out. The students who get it right can be rewarded by venturing back through the system and collecting the cards so you don't have to do it.
  - As they exit the system, sit them down and explain why they should be holding nitrogen, and expand on what happens to the bay when too much nitrogen gets in it…algae blooms, low DO, fish kills, loss in eel grass, habitat declines, dead shell fish, etc.

Clean-Up

During the Festival

- Having one or two students clean out the system means you don't have to crawl in there every time and makes them feel like they're getting a reward.
- In between groups, reorganize the cards so they're easier to hand out.

After the festival

- Take apart the septic system.
- Empty all of the containers and re-sort the contaminant cards so they are ready for the next festival.