

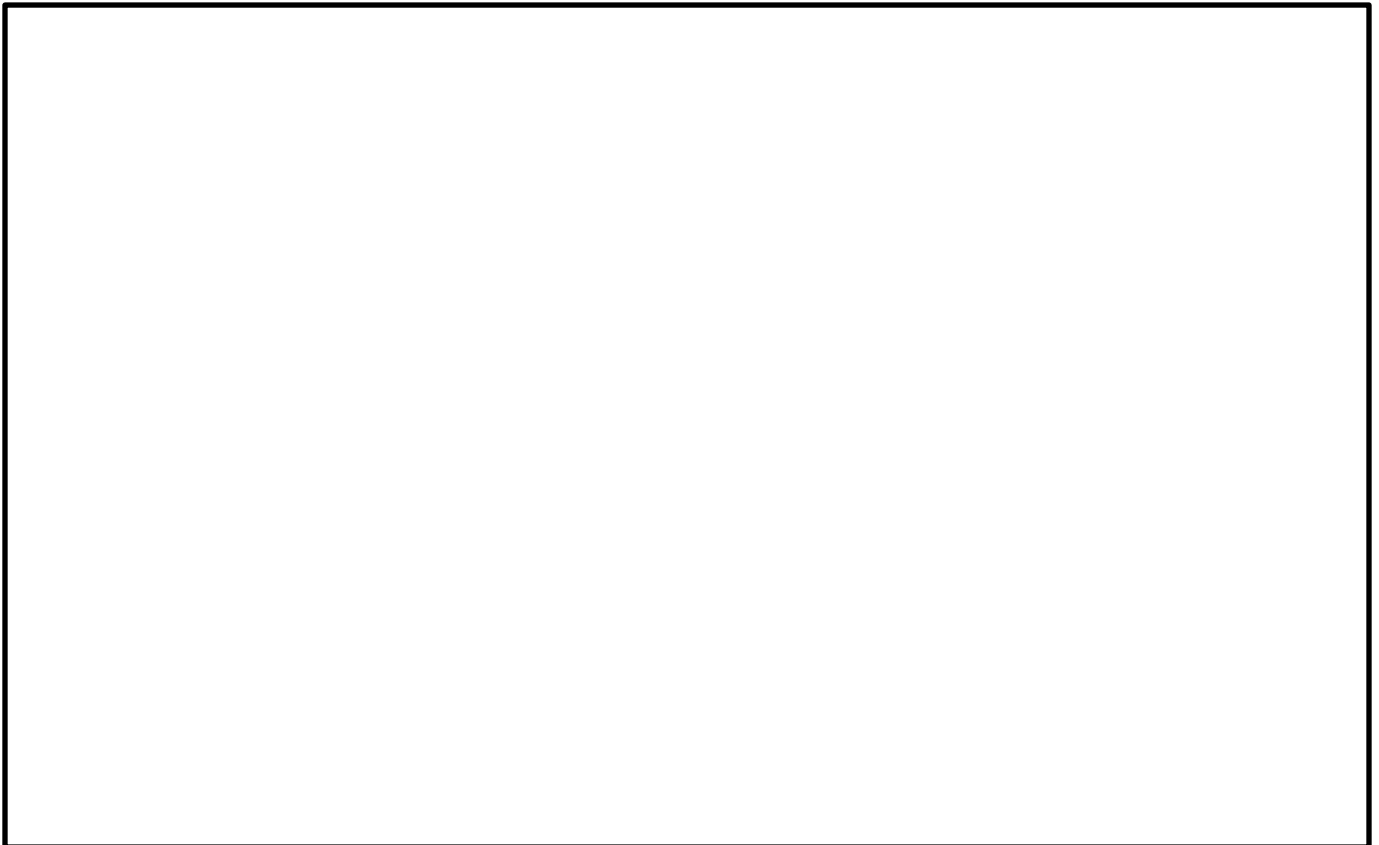
What a Dump

Materials

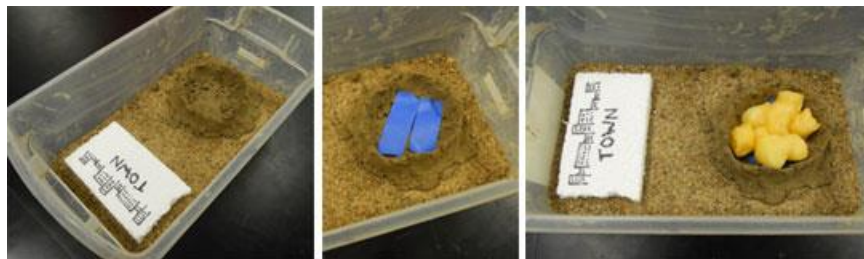
- food coloring
- clear plastic tub in which to mix together food coloring, water, and cotton balls ("garbage")
- (optional) gloves or spoon to "mix" the garbage
- strips of plastic garbage bags, to simulate geosynthetics used in landfills
- toothpicks
- straws
- popsicle sticks
- small, paper "Dixie" cups (~85 ml size), to measure and distribute clay, gravel and sand
- access to water
- watering can, water bottle, or other "rain storm" device

Instructions

1. Get into groups of four students each.
2. Each group must design a landfill that (a) can hold the most garbage, (b) minimizes the cost, while making sure that, (c) the landfill is able to contain the waste during a rainstorm without allowing leachate to get to the town. As you do this, just like engineers, you will be following the steps of the engineering design process: understand the need, brainstorm different designs, select a design, plan, create, test, analyze and improve.
3. Draw out his/her team's landfill design below.



4. Have designs approved and receive supplies.



5. Construct the base liner systems for their model landfills (see photo, above). The goal is to keep water from getting out of the landfill. Therefore, materials such as clay and geosynthetics are good choices, because water cannot flow through them easily. (Basically, the liner should look like a clay bowl or box. Of course, not all teams will choose this path – so you may see Popsicle sticks, toothpicks, etc., at this stage. The word “system” is used because students can use a combination of materials to make base liners [however, because of the budget constraint, they cannot afford to buy many things].) Remember to save some funds to purchase materials to build your top cap (to put on after the garbage is inserted). A landfill without a top is no good for anybody!

6. Fill the landfill with “garbage” (see photo above) making sure not to let the food coloring seep out into the area around the landfill before construction is completed. Count how many cotton balls you put in. Have the Project Engineer tell you how many to put in.

7. Record the quantity of garbage cotton balls that their landfills can hold on the worksheet.



8. Finish constructing the top cap liner systems for their landfills (see photo, above). The purpose of the top cap is to keep the rain out of the landfill. Therefore, like the bottom liner system, it should be made of materials water cannot flow through. Additionally, some protection (such as gravel) can be placed on top to keep rainwater and sunlight from eroding away the liner.

Test the landfill performance:



1. Create “rainstorms” by pouring water on the model landfills (see photo, above).
2. Use a pencil or Popsicle stick to dig into the sand outside of the landfill and near the town to look for any seeping food coloring (leachate) (see photo, above). Make multiple soils tests.
3. Repeat the rainstorm, if desired.
4. (optional) Apply other erosion forces to the model landfill, such as wind or earthquakes.

Debrief Questions:

- So what should be put underneath all the trash in the landfill?
- How about once the landfill is finished?
- Should we cover the landfill or leave it open to the air?
- What should we cover it with?

Resources:

<http://teachers.egfi-k12.org/what-a-dump/>