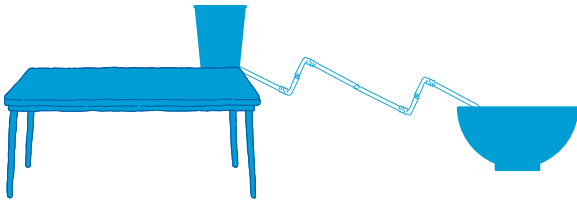


## ACTIVITY 3: ENGINEER A MODEL SEWER SYSTEM



*Image Credit: Gary Abud, Jr.*

In this activity, students will engineer a simple gravity sewer to transport "wastewater." This will simulate how sewage is drained away from homes or businesses into a city's waterways using gravity.

### **Materials:**

- Water
- Clear plastic cups
- Clear plastic straws (straight, flexible, or loopy)
- Sharpened pencil
- Modeling clay
- Scissors
- Tape
- Food coloring
- Poppy seeds
- Bowl or disposable aluminum 1/4 size pan

Before beginning, determine if all groups will have the same parameters, or if the level of challenge can be variable, by choosing how many straws they can/must use, what minimum distance they need the water to travel, how many turns are required, and where the starting and ending locations\* will be for the "home" (e.g., the cup) and the "sewer" (e.g., the bowl).

Have students team up in pairs to make their sewers and make materials available for them to get. Explain the task and challenge ahead of them: to make a sewer that will move water a certain distance. Elaborate that they will be building a gravity-powered sewer drainage system to simulate dirty water being carried away from a home and dumped into a sewer.

The cup will represent the home; the straws the home's sewer line; food coloring and poppy seeds are waste; and the bowl will represent the city's main sewer.

First, have them use the sharpened pencil (or scissors) to poke a small hole close to the bottom in the side of the cup. The hole should be just smaller in diameter than the straw. Snugly insert a straw through the hole; it is up to students which end of the straw to use. They can seal around the hole using clay or tape if needed to prevent leakage.

Next, allow students to determine how they will connect and orient the angles of multiple straws to get their sewer to travel where it needs to, given any established parameters. Monitor them as they construct their sewers to remind them they can seal straws together using tape as needed and to ensure the angle of the straws generally slopes downward.

Then, allow them the opportunity to test their sewers with clean water by filling another cup and pouring into their cup to track the water as it makes its way into the bowl. Allow them to make any adjustments, add supports, or seal any leaks as needed. Encourage them to keep track in their notes of any "upgrades" they made to their sewer system before the final challenge.

Last, give students the challenge to move some "wastewater" through their sewer. They can make their own wastewater or you can provide it premade to save time. Either way, have them pour the "wastewater" into their sewer and observe it travel into the city's "main line." Ask them to consider what's happening, how it is happening, and why it is happening.

Extend their thinking by having multiple groups drain their sewers into the same bowl at the same time, and ask them to notice what's happening? As they see the bowl starting to fill, ask them to consider what would happen to the bowl if we were to also pour some additional clean water (e.g., "rainwater") into the bowl at the same time the sewers were draining?

Help them to see the need for a sewer system to have its own drainage system that goes somewhere else, like a local body of water, and why its key to keep the rainwater separate from the raw sewage.

**\*Teaching Tip: Staircases or ramps make great locations for this challenge.**