

## How to Build Surface Runoff & Groundwater Recharge Infiltration Models



### Materials (for building one model)

- Sturdy plastic container with flat sides (3-Liter “Really Useful Boxes” work well)
- Two  $\frac{3}{4}$ ” 45° elbows
- One  $\frac{3}{4}$ ” coupler (cut in half with a ratcheting PVC cutter to make two)
- Two pieces of  $\frac{3}{4}$ ” PVC tubing (cut  $1\frac{1}{2}$ ” in length)
- Four # 18 O-Rings (optional)
- Adhesive for bonding plastic to plastic (optional)
- 1” spade bit and drill
- Ratcheting PVC cutter

### Additional materials for experiments (per model)

- Small watering can
- Two clear containers (large enough to hold 250–500 mL of water) to catch the runoff and recharge (i.e. graduated cylinders, measuring cups, or plastic cups)
- Potential Groundcovers: Plants (native vs. nonnative), different types of soil (can be obtained from your own yard, the schoolyard), compost, sand, clay, limestone, and concrete (can be made with a bag of Quikrete)

### Procedures

1. Drill a hole near the top left of the box using a 1” spade bit. This hole will be for the surface runoff spout. Next, drill a hole near the bottom right of the container. This hole will be for the groundwater recharge spout. If the holes have jagged edges they can be shaved off using a Pocket Knife, X-Acto Knife, or file in order to have a clean cut.
2. Slide a  $1\frac{1}{2}$ ” long tube cut from  $\frac{3}{4}$ ” PVC through each hole so half of the PVC tube is sticking out of the hole. Note: this is a very tight fit in order to prevent water leakage. If it is not possible to slide in the PVC, you can widen the hole a little using a Pocket Knife, X-Acto Knife, or file. Try to make as tight of a fit as possible in order to maintain a waterproof seal.
3. Place # 18 O-Rings around each side of both PVC tubes (these are optional, but will help provide a waterproof seal).

4. Attach a surface-runoff spout made of  $\frac{3}{4}$ " 45° elbow onto the tube on the outside of the box. On the inside of the box, slide a  $\frac{3}{4}$ " coupler (that has been cut in half) onto the tube, and push together for a tight fit. Tip: hold an object with a hard flat surface against the coupler while you push the elbow toward the coupler. Attach the groundwater recharge spout using the same procedures.
5. Optional: If you are using a "Really Useful Box", you can use the lid of the container as a little stand to help protect the bottom spout. If you want to glue the bottom of the container to the top of the lid, you must use a special adhesive that specifies it can bond plastic to plastic.

### Pictures to help identify parts and how they fit together



$\frac{3}{4}$ " PVC tubing with #18 O-Ring (black) and coupler cut in half (on left).



Same picture as above with another #18 O-Ring and the  $\frac{3}{4}$ " 45° elbow added. Note: the coupler and one O-Ring should be on the inside of the container and the other O-Ring and  $\frac{3}{4}$ " 45° elbow should be on the outside of the container. All parts should be pressed together tightly to make a watertight seal.

Instructions for creating four ecosystems: concrete, compact soil, nonnative grass, and native plants. Line the bottom of the containers with limestone gravel up to the middle of the bottom spout (I use limestone to mimic Austin's geology, but other types of rocks



could be used in other localities). Fill one of the boxes with soil to the surface runoff spout (slightly above the bottom of the spout, but below the top of the spout). Use the same soil to plant grass and native plants in boxes so that the surface level of the plants is slightly above the bottom of the surface runoff spout (but below the top of the spout). For the container with concrete, fill in soil to 2" below the bottom of the surface-runoff spout. Quikrete should be prepared outdoors (or in a well-ventilated area) as the instructions on the bag indicate (add water to the powder in a mixing bucket with a mixing stick). Then use a spoon to add a 2" layer of Quikrete on top of the soil up to the surface-runoff spout (slightly above the bottom of the spout, but make sure not to clog the spout with concrete). Allow 24 hours to dry. Place the boxes on a table (or box or crate) with the back ends slightly elevated (small blocks of wood can be used to create the desired slope). Next, place containers (graduated cylinders, measuring cups, or plastic cups) under the spouts to catch the surface runoff and groundwater recharge.

### Additional tips

Have towels handy to clean up any spilled water. If soil clogs the runoff spout (especially for the model with only soil), then use a pencil or poking stick to unclog the spout. If the containers develop leaks, try using a silicone sealant where the leak is occurring.

**For more information and links to lesson plans, see:**

[www.austintexas.gov/Watershed/YouthEd](http://www.austintexas.gov/Watershed/YouthEd)