

## Water Week: Clean It Up!

Water is important to life on Earth but how can we make it safe to use and can we re-use it? Learn about the importance of water and take on a challenge to create your own filtration system and clean up some polluted water!

### Supplies:

- Water
- Plastic bottle, milk jug, or other clear container
- Assortment of “filtration” materials:
  - Napkins
  - Paper towels
  - Coffee filters
  - Cotton balls
  - Clay
  - Sand
  - Gravel/small pebbles
- Assortment of “pollution materials”:
  - Dirt
  - Small objects like paperclips
  - Food scraps like peels
  - Pieces of leaves/grass
  - Food coloring
  - Oil
  - Salt/other spices
- Tape or rubber bands
- Scissors

### Importance of Water

**How have you used water today?** Stop and think about it! Make a list!

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You probably thought of things like drinking or cooking or taking a shower, but did you think about things like brushing your teeth? Going swimming? Watering your yard? Giving your pets a drink? Flushing the toilet? Water is very important to our life on earth, we need it to survive! In fact, you can survive several weeks without food but only a few days without water! And we use a LOT of water each day. The average American uses 80-100 gallons of water each day. . .that’s **2-3 bathtubs** full for just one person! How many people live in your house? How many bathtubs full of water are you using each day?



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**each day!**

We use a lot of water each day, but there isn't a lot of useable water in the world. Even though our planet is covered with water (over 70% of Earth is water!) only about 3% of the water on Earth is not salt water. . . and only about 1% of that 3% **freshwater** is usable (not locked up in glaciers, ice, the soil, or too polluted)! We have just a tiny amount of water to share with this whole globe, and as population and pollution increase that amount gets smaller and smaller! In dry or **arid** places (like here in Colorado and other parts of the American West) water is even more valuable!

Since water is so valuable it's important to use every last drop! But water that flows in our rivers and streams isn't useable for drinking, cooking, and cleaning right away. . .it contains **pollutants** and **microorganisms** that are harmful to humans. Is there a way to clean this water so it is safe to drink and use? We also waste a lot of water down our sinks, drains, and toilets. . . is there a way to clean and re-use this water too?

There sure is a way to clean and re-use our water! **Filtration** is one of the best ways to start cleaning up our water so it's safe to use. Filtration is the process of removing particles and pollutants from a liquid, and it's how we start cleaning up our water (we also use safe chemicals and other to kill microorganisms and make the water **potable** which means "safe to drink"). While anyone can build a simple filtration system, **Civil Engineers**<sup>1</sup> help design and build water treatment plants for our cities to help filter our water and make it safe for us to use. Today in our engineering challenge see if **you** can come up with a filtration system that can filter your polluted water! (Check out the worksheet at the end to help guide you!)

**Note:** The filtration methods used in this activity are a simple demonstration and the water should not be considered safe for drinking

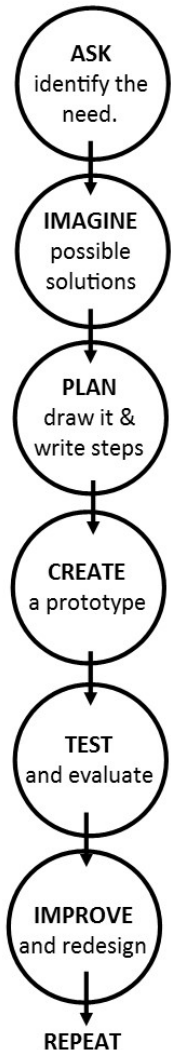
## Engineering Challenge: Design A Water Filtration System!

**Start** by thinking about some sources of water pollution. If you turned on your faucet and no water came out, where would you find water near your house to use? What do those places look like? What could be polluting that water? Would you be ok drinking it?

1. Thinking about the things that can pollute our water, mix up some polluted water of your own! Fill a jar or cup with some water and add pollutants! You could use bits of grass and leaves, dirt, oil, spices, small objects like paperclips, and food coloring. Ew! Gross!
2. Gather your filtration supplies. You can use a variety of items, but we suggest a combination of napkins, coffee filters, paper towels, cotton balls, clay, sand, and gravel.

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<sup>1</sup> (You can learn about Civil Engineers and do another water based engineering challenge in our "Engineering Challenge: Civil Engineering" Discovery at Home).



3. Create your filtration system base. Cut the top off a plastic bottle, jug, or carton several inches below the top. A 2 liter soda bottle works best, but you can use a water bottle, juice jug, or even the top of a milk jug or carton. Place the top of your bottle inside the bottom or suspend over a pitcher or jar. Secure the two together with tape.

4. Now we're ready to start thinking like an Engineer and designing our filtration system! We're going to use the Engineering Design Process to help us reach a solution today! (see steps on left). First, let's **think about what is the problem that we're trying to solve?** (Our water is polluted, and we need it clean!) Look at that polluted water you made:

- What types of pollutants do we need to filter out?
- Which of the filtration materials we have could help filter them out?
- What are some possible solutions to our problem? How could you design your filtration system?

Next, draw your idea for your design.

5. Build your filtration system! Using the materials create layers in the top half of your filtration system base. At the end you'll be pouring your polluted water into the top and watching it go through your filters to drip into the bottom. You want the water in the end to be as clean as possible! Think about:

- Which materials can filter which size pollutants?
- How can you order the layers to work the best?
- Predict which layer will filter which pollutants.

6. Once you're done designing it's time to test your filtration systems! Give your polluted water a mix and then pour it in the top! Watch the water move through your filtration system. Observe what the water looks like at the end.

- Does the water look cleaner?
- Are there any pollutants you weren't able to filter out?
- Are there pollutants you can't see but are probably still there (e.g. oil)?
- How could you remove the pollutants that you can't see or couldn't filter?
- How would you feel about drinking this water? Do you think you'd get sick? What about microscopic pollutants and organisms?

**NOTE:** The filtration methods used in this activity are simple demonstration and the water should not be considered safe for drinking.

7. Take apart your filter and look at each of the different layers. Can you tell what each material filtered out? Did any of the materials surprise you by doing a better (or worse) job than you expected?

## Level Up:

1. Real engineers learn from their tests and try again to create an even better system!  
Empty the bottle, throw out your old filter materials, wipe out the bottle and try again! See if you can make the water even cleaner!
2. Challenge someone! Make a big batch of polluted water and see who can filter it best!

# Clean It Up!

How have you used water today?

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How many bathtubs full of water is your family using?



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X 2



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each day!

# people in your house

The average American uses 80-100 gallons of water each day!

What are some things that pollute water?

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Draw a picture of a water source near where you live.

# What is the problem we're trying to solve?



What types of pollutants do we need to filter out?

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Draw a picture of the polluted

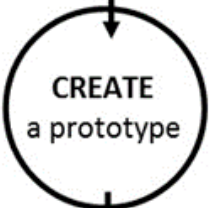
Which materials can help filter which pollutants?

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REPEAT

Draw a design for your filtration system

## Observe:

Was your water cleaner? What couldn't you filter out?

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