All living things need water. Without water, there would be no life on Earth. Because of this, water is our planet’s most precious resource. We use water in so many different ways without thinking about it. Can you write down some ways you used water today?

Why Water?

How do we use water in agriculture? Farmers and ranchers need water to raise the animals and crops that we use for food, fiber and fuel. Because we have a limited supply of water, we must conserve and use it wisely. What are some things you can do to make sure you do not waste water?

Where is the Water?

Around 97% of the water on Earth is salt water and undrinkable. Oceans are salt water and more salt water is found inland in seas and lakes, like the Great Salt Lake in Utah and the Sea of Japan.

The remaining 3% is fresh water, but most cannot be used directly for drinking or agriculture because it is frozen in polar ice caps. Furthermore, tiny amounts are vapor in the atmosphere. What does this all boil down to? Less than 1/3 of all the fresh water is available for use. Most of this fresh water is found in lakes, rivers, streams, and underground.

What do those numbers mean?
Let’s take a look.

- Start with a gallon of water. This represents all the water on Earth.
- Pour ½ a cup of water from the jug. This ½ cup represents all fresh water on Earth. The water left in the jug is salt water found in the oceans.
- From the ½ cup, use an eye dropper and take out one drop. This one drop represents all fresh water available for our use. This water is found in rivers and lakes. The rest of the ½ cup is deep groundwater, water bound up as soil moisture, biomass water or water in the atmosphere.

Write a paragraph explaining what you think the main idea of this activity is. Create a bar graph or a scaled picture to represent the data described above in the box below.
States of Water

Water is a basic need of all living things and can be found in almost everything around us. It is also very important to agriculture. Farmers rely on rain for plants to grow and for animals to drink. Protecting the water we have and keeping it clean not only helps produce better foods, but also keeps our earth healthy. Water may seem simple. It has no taste, no smell and no color. But water is more than it appears to be! Read on to find out why.

Water is known as the “universal solvent” because more substances dissolve in water than any other liquid. This means that wherever water flows, in the ground or through the human body, it picks up and carries along nutrients, chemicals and minerals.

Water is the only natural substance on Earth that can be found in all three physical states. Liquid water is found in rivers, lakes, streams, and even swimming pools. Vapor is moisture that forms in the clouds and in the air and is what makes us feel sticky on humid days. Ice is water that freezes. Ice cubes and the ice caps at the North and South Poles are examples of ice.
The Mighty Mississippi

Few rivers have played such an integral role in shaping our nation’s historical, cultural, and economic heritage as the Mississippi River. The North American Indians that once lived on the banks of the Mississippi River called it “Messipi” (“Big River”) or “Mee-zee-see-bee” (“Father of Waters”). It is one of the world’s greatest river systems. This major river originates as a tiny outlet stream from Lake Itasca in northern Minnesota and flows 2,350 miles to the Gulf of Mexico. It drains all or parts of 31 states as well as two Canadian provinces. The drainage basin is 1.15 million square miles, which is roughly 1/8 of North America, and extends from the Appalachian Mountains in the east to the Rocky Mountains in the west. The river discharges 612,000 cubic feet per second into the Gulf, which is equal to 166 semi-trailers per second. Roughly 12 million people live in the 125 counties or parishes that border the river. It also provides habitat for at least 260 fish species and 40% of the nation’s migratory birds, as well as 38 mussel species, 50 mammals, and 145 amphibians and reptiles on the Upper Mississippi alone.

The Mississippi is also one of Illinois’ greatest agricultural assets. Corn and soybeans, as well as other crops, travel down the Mississippi River to New Orleans where they are loaded onto large ships and transported around the world. The river allows us to transport large amounts of grain at very little cost. Barges, or flat-bottomed boats, can move one ton of cargo 576 miles per gallon of fuel. A rail car would move the same ton of cargo 413 miles, and a truck only 155 miles. Using river transportation also generates fewer emissions than rail or truck.

Locks and Dams

In 1930, U.S. Congress decided to make the Mississippi River wider and deeper so boats could move all the time. First, dams were built. Dams hold water back to make sure every part of the river is at least nine feet deep. That’s deep enough to float heavy barges up and down the river. But how do barges get around the dams? Each dam has a lock. A lock is like an elevator – only slower. A tugboat pushes a barge into the lock (elevator). The doors close and water is put in or taken out of the lock. This raises or lowers the barge until it is at the same height as the water on the other side of the dam (elevator moves up or down). The doors open up and the barge goes on its way. The whole process can take up to two hours.

The Mississippi River is divided into the upper Mississippi (from Cairo, Illinois, up to its origin at Lake Itasca in Minnesota) and the lower Mississippi (from Cairo, Illinois, south to the Gulf of Mexico). There are 29 locks and dams on the upper Mississippi from just north of St. Louis, Missouri, to Minneapolis, Minnesota. There are no locks and dams south of St. Louis. Instead, there are wing dams to control the flow of water and levees to contain the river during flooding.

Why do engineers go to all this trouble? Why don’t they just let boats travel freely along the Mississippi River? In what situations do boats need locks? Brainstorm ideas as a class and write answers on the board.
Conservation

The amount of water available for human use is limited. We need to make sure we do our part to conserve water. Factors such as drought, flood, pollution, population growth, industrial needs, and others may lead to a shortage of water. Listed below are some ways to conserve water. Can you think of others?

- Turn off water faucets when they are not in use – do not run the water when brushing your teeth or rinsing dishes.
- Use a broom to sweep off sidewalks instead of hosing them off.
- Water lawns less often.
- Use less water in the bathtub.
- Use drip irrigation systems to water plants.
- Water gardens in the early morning when evaporation is lower.
- Take shorter showers.
- Install low-flow or more economical showerheads.
- Use water conserving toilets or put a capped bottle of marbles or rocks in the tank to decrease water use.

Water and Agriculture

Water is a very important natural resource for farmers and ranchers raising crops and livestock for the food we eat, as well as the fuels and fibers we use on a daily basis. Farmers’ livelihood and way of living depends on their ability to use the land. So it is in the farmers’ best interest to help protect the land because they rely on it.

All living things need water. Because there is a limited supply of water, everyone must practice conservation, preservation and moderation to protect the water we have. Farmers use both common sense and technology to help conserve water and to preserve water quality. In the last decade, farmers have worked to use nutrients for their crops more efficiently in order to minimize nutrient loss. Farmers also use a wide variety of technology to apply fertilizers and pesticides in specific places and at specific times to help plants grow and to minimize loss. This helps keep costs down for the farmer, as fertilizers and pesticides are very expensive. It also helps to keep the environment and our water supply clean. Some farmers also use buffer strips and cover crops to reduce runoff that could impact water quality. Livestock farmers and ranchers put fences up around streams, rivers and ponds to keep livestock out of the water. Many farmers also practice both crop and pasture rotation. Crop rotation breaks up insect cycles reducing the need for insecticides while also helping to add nitrogen back to the soil. Farmers have long used these types of stewardship practices of the land and the water in order to guarantee both are around for generations to come.
Watershed

A watershed is a geographic area in which water, sediments and dissolved minerals all drain into a common body of water like a stream, creek, reservoir, or bay. A watershed includes all plants, animals, and people who live in it, as well as the non-living components like rocks and soil. We are all part of a watershed, and everything we do can affect the surface and ground water that runs through this system.

A Watershed in your Hand

Using a washable marker, draw dots all over a piece of white paper. Now, wad the paper up tightly. Carefully unfold the paper, but don’t flatten it out. You will see there are a number of high and low spots all over your paper. Let’s pretend this sheet of paper represents the land. The high spots are mountains or hills, the low spots are the valleys. The dots you made represent possible pollutants - loose soil, chemicals and debris – that may pollute our water system. Lay your paper down on the table and using a spray bottle mist the paper. Watch how your dots begin to wash away and travel over your paper. This is a watershed. Just like on your paper, the earth has high and low spots. As rain or melted snow travels over the land, pollutants are collected and carried into streams, rivers, lakes and eventually the ocean. Discuss methods farmers use to protect watersheds.

Irrigation

Irrigation is the artificial application of water to land in order to assist plant growth and production. In areas with less rainfall, or during periods of drought, farmers use irrigation to supplement the amount of water needed to produce a crop.

Irrigation waters can come from groundwater by using wells, or from surface water removed from lakes, rivers or reservoirs. A reservoir is a man-made body of water that stores water from heavy rains. Irrigation practices today incorporate more resourceful sprinkler systems. This allows farmers to use about half the water that was used 20 years ago.
Water Cycle

The sun heats up water in rivers, lakes and oceans and turns it into vapor. The water vapor leaves the river, lake or ocean and goes into the air. This step is known as evaporation.

Water vapor in the air cools and changes back into liquid, forming clouds. This is called condensation.

When water condenses and the air cannot hold it anymore, the clouds get heavy and water falls back to the earth in the form of rain, hail, sleet, or snow. This is called precipitation. When water falls back to Earth as precipitation, it may fall back into the oceans, lakes, or rivers or it may end up on land. When it ends up on land, it will either soak into the Earth and become part of the “ground water” used for plants and animals, or it may run over the soil and collect in the oceans, lakes, or rivers where the cycle starts all over again.

Water Cycle Bracelet

This activity uses 10 beads that represent the water cycle. The beads are used to show the paths water takes through its various states (solid, liquid and vapor) as it moves throughout Earth's systems (oceans, atmosphere, ground water, rain, streams, etc).

Give each student a piece of yarn, leather, rope, or a pipe cleaner. Show the students that each colored bead represents a different stage of water in the Earth's systems. Ask the students to string one of each colored bead on their bracelet. Tell them to string the beads in any order they like. After the bracelets are complete, ask the students to show you their personal water cycle. For example, if their beads are in the following order: clouds, puddles, plants, etc, the students explain that the water started in the clouds, then it rained and fell into puddles on the sidewalk, then the water evaporated and collected on the plants overnight. Each student will have a different water story to tell.

The beads and what they represent are as follows:

- Sun (yellow) – the sun is the source of all energy on Earth and powers the water cycle.
- Water Vapor (clear) – the part of the water cycle where water is suspended in the air or is steam and humidity.
- Clouds (gray) – when water vapor condenses but is still in the air.
- Rain (sparkling clear) – moisture from clouds falls to the Earth as a liquid.
- Snow (white) – moisture falling as a liquid in the frozen state.
- Erosion (brown) – rain causes erosion where soil is unprotected by vegetation. Soil particles are suspended in the water runoff.
- Oceans (dark blue) – Earth's weather factory. Moisture evaporates from the oceans by the sun's heat and is carried around Earth by winds.
- Lakes (sparkling blue) – the way we like to see a lake. Collects water from streams, and also evaporates water into the atmosphere.
- Puddles (sparkling brown) – rainwater collects in low spots, streets, and sidewalks, and it also collects pollutants (dirt, trash, car fluids, etc). Puddles evaporate or go into storm sewers.
- Plants (green) – Plants take in water through roots and evaporate water into the atmosphere through leaves – a process called transpiration.
Explain the Illinois Environmental Protection Agency?
The Illinois Environmental Protection Agency’s (IEPA) mission is to safeguard environmental quality, consistent with the social and economic needs of the state, so as to protect health, welfare, property and the quality of life for the citizens of Illinois.

What types of projects do you work on?
As a Community Relations Coordinator, it is my job to ensure the public receives accurate and timely information about IEPA activities, offer the public the opportunity to provide input on environmental decisions, foster communication between technical staff and the regulated community, local officials and citizens affected by our agency’s activities and identify and remove obstacles that interfere with the successful implementation of Agency programs. I also have the opportunity of doing all those above mentioned tasks on a different level with children. I am able to go into classrooms, Boy or Girl Scout meetings, and summer programs engaging school age children while tasking them to become good environmental stewards.

How did you become interested in your job?
I’ve always loved working with others. I consider myself a “people person.” I have a bachelor’s degree in education so I’m able to combine my love of education, working with the public and helping to protect our environment.

What is your favorite part of your job?
My favorite part of the job is being face to face with the public. I love talking about any environmental issues with children and adults, whether it be working in a classroom and doing a hands on presentation or participating in a public meeting on important environmental concerns for the citizens of Illinois.

Tell us about Living Lands and Waters.
Living Lands and Waters is a non-profit environmental organization that was established by Chad Pregracke in 1998. He spent a lot of time playing, fishing, and working on the Mississippi River growing up. It was during this time on the river that he noticed all the garbage. After getting tired of seeing the garbage, he formed the non-profit organization Living Lands and Waters. The first year it was just Chad going out every day by himself in his flat bottom boat picking up garbage. Today, the organization has grown to be the only “industrial strength” river cleanup organization like it in the world.
The Living Lands and Waters crew host river cleanups, watershed conservation initiatives, educational workshops, tree plantings and other conservation efforts. The organization recycles a lot of the garbage it collects. All of the scrap metal and tires are recycled. The bagged garbage is even sorted through by volunteers and plastic bottles and cans are removed to be recycled.

What is the biggest problem that your organization faces?
The biggest problem the organization faces is finding all the plastic bottles and styrofoam in rivers. These items are not only unsightly but they can also leach toxins into rivers. They also can break down into smaller pieces and wildlife like fish and birds can mistake it as food which is harmful to them. Rivers are important for a variety of reasons but one of the most important is they are a source of drinking water. Eighteen million people get their daily drinking water from the Mississippi River.

How did you become involved in cleaning up rivers?
A friend I grew up with worked on the crew and introduced me to Chad and the organization. I started volunteering with Living Lands and Waters nine years ago. This eventually led to my decision to come on full time seven years ago. I also have had a passion for the environment instilled in me by my parents.

What advice would you give youth today?
Get involved! Find a cause you’re passionate about and volunteer. Volunteering is what led me to my job which I love. Also reduce, reuse, and recycle! Keep it clean!
Explain American Water.
Illinois American Water, a wholly owned subsidiary of American Water (NYSE: AWK), is the largest investor-owned water utility in the state, providing high-quality and reliable water and/or wastewater services to approximately 1.2 million people.

What do you do?
As a water quality supervisor, my work first and foremost focuses on ensuring quality water service to customers. Water service is very personal – our customers drink our product and they count on us to ensure that it is safe and reliable. Drinking water also supports community growth and provides fire protection. Specific projects that I am involved with may focus on optimizing water treatment, solving challenges at plant sites and ensuring our water treatment plants are in compliance with state and federal regulations. I also partner with local environmental stewards on projects to protect our precious water resource.

How did you become interested in your job?
I first became interested in water microbiology in college when I did a senior project looking at antibiotic resistant bacteria in surface water. As luck would have it, shortly after I moved to Champaign, I applied for a laboratory technician job with the water company.

What is your favorite part of your job?
Illinois American Water provides a critical service – one that is essential for life. This is a great responsibility and privilege. I enjoy the ability to work with different types of water systems. The service areas I am involved with include Champaign, Pontiac, Sterling and Streator. These systems vary in many ways including source water and size, allowing for different challenges and opportunities. No two days are ever exactly the same and there is always something new to work on.

Elizabeth Doellman
American Water | Champaign, IL

Tell us about your job.
My company owns and operates towboats and barges, which are used to haul a variety of cargos in large quantities via the Inland Waterways (rivers). I specifically manage the Illinois River which connects the Mississippi River (near St. Louis) to Chicago and Lake Michigan. These barges carry products such as grain, fertilizer, road salt, steel, petroleum coke, wood mulch, and ethanol. On this river, one towboat typically pushes 15 barges at a time.

How did you become involved?
I grew up on a farm in Western Illinois and spent my summers boating on the Mississippi River. After college, I found myself in Nashville, Tennessee, looking for a job. Ingram shared the same values and passions that I grew up with, and the Illinois River was naturally familiar to me. After 5 years, I still love what I do!

What is your favorite part of your job?
Being involved with the “nuts & bolts” of the operation gives me great job satisfaction. Each day it feels like I’m putting together a puzzle, while the pieces are changing constantly. I’ve learned not to give up so easily and keep trying to make it work. Eventually, the answer will fall in your lap.

What changes do you see for the future in the industry?
Hopefully, we will see more government dollars toward repairs for our aging lock & dam system. These needed improvements would enable Illinois farmers to get better prices for their crops.

Carissa Koeller
Ingram Barge Company

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