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GRADE 5
MODULE 3
DQ5

H2O Response Team: Our Water Impact

Monday, April 4th

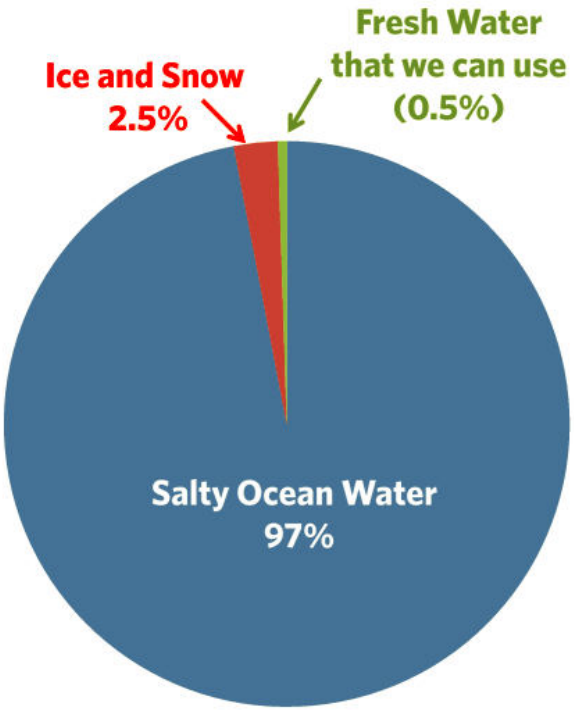
Lesson 1

Conservation Solutions: Daily Activities

Teachers:

Please put the slides in present mode for best viewing

Distribution of Water on Earth



REVIEW from yesterday

What if I told you:
you **eat** 3496 litres of water
EVERYDAY

Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

Eating water might sound strange, but you are about to discover that actually you eat loads of it, you are addicted to it, and you don’t know it.

Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

An understanding of our water consumption can help us provide a solution to one of our most pressing problems: making sure there is enough water for everybody on the planet.

Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

You can be part of that SOLUTION.

Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

WHAT IS VISIBLE

Much of the water we use is obvious it's visible in our homes. It's the water we use at home for drinking, cooking, washing. That is our **domestic consumption.**

Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

DOMESTIC CONSUMPTION

Our domestic consumption is **137** litres of water everyday.

Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

HOW WE MANAGE IT

This is **how we manage** those **137** litres.

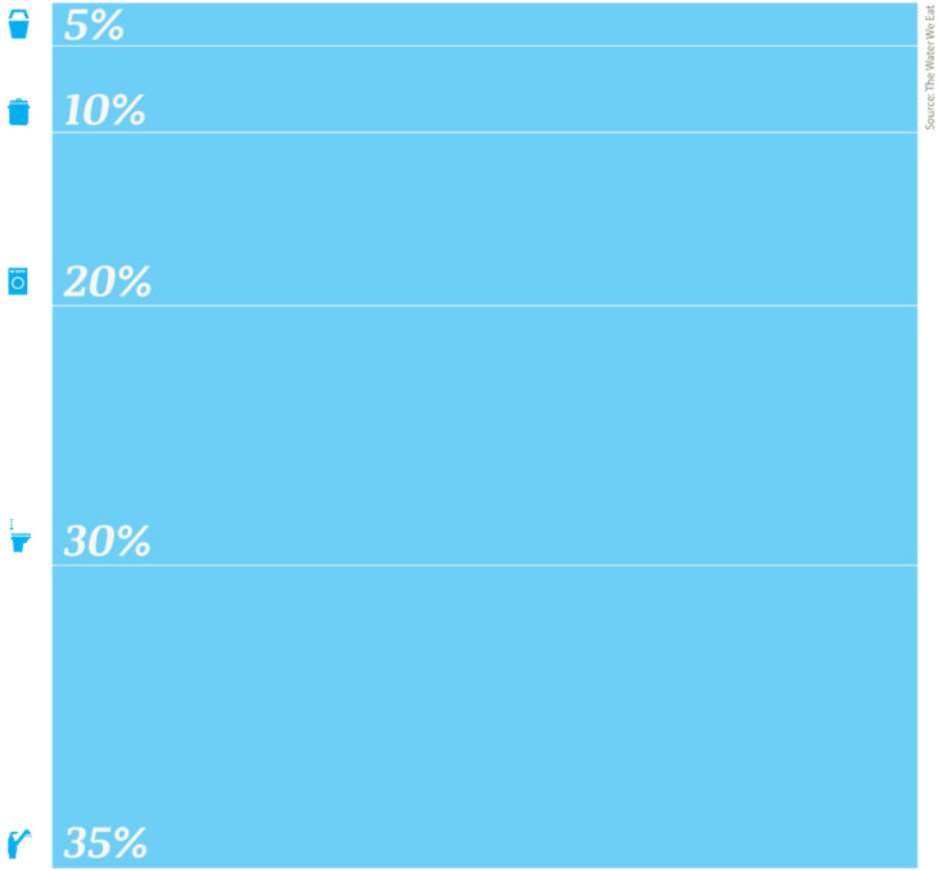
5% Cleaning

10% Cooking and drinking

20% Laundry

30% Flushing toilet

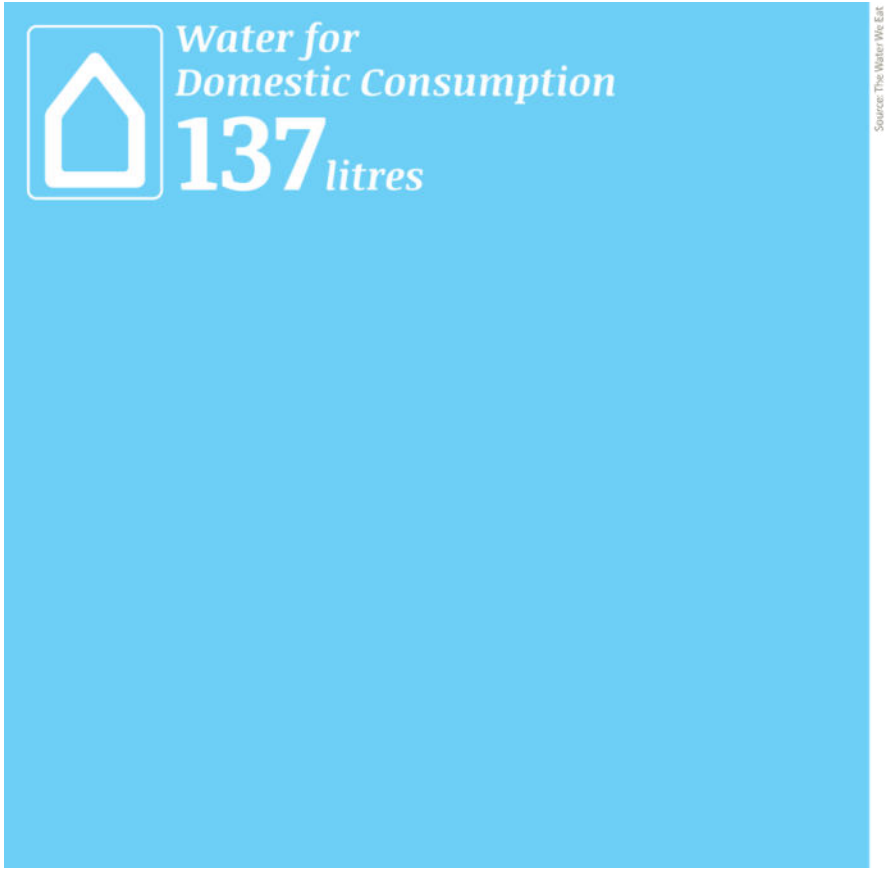
35% Bathing and Showering



Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

A LITTLE PROBLEM

There is a little problem though, because what we consume at home is visible to us, but it is only a small bit of what we use in total. There are two invisible parts.



Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan
11

FIRST INVISIBLE PART

The first invisible part is the water used for the production of the industrial products we consume everyday, such as paper, cotton, clothes. This part amounts to **167** litres per day.

Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

How much water does the average American use per day?

Home and personal use
(drinking, showering, flushing toilets, watering lawns, etc.)



200 Gallons

Products
(clothes, electronics, furniture, etc.)



200 Gallons

Energy
(gasoline, electricity, etc.)


600 Gallons

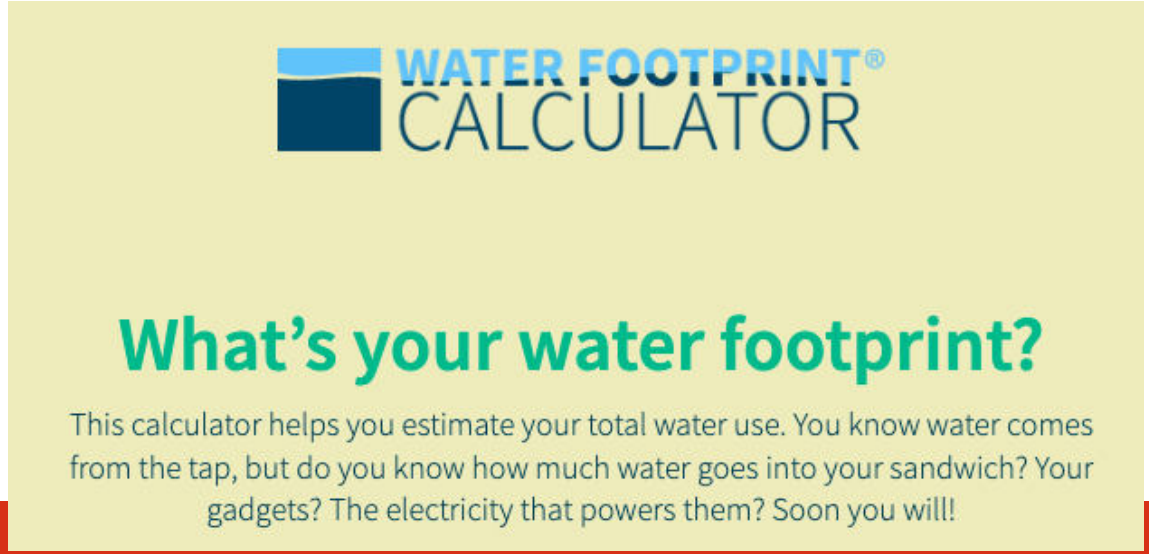
Food production
(farming, food industry, etc.)


1,000 Gallons

Due by Friday:

[Water Footprint Calculator]

Teachers: This has already been posted on your Google Classroom for your students!



 Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

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GRADE 5
MODULE 3
DQ5

H2O Response Team: Our Water Impact

Tuesday, April 5th

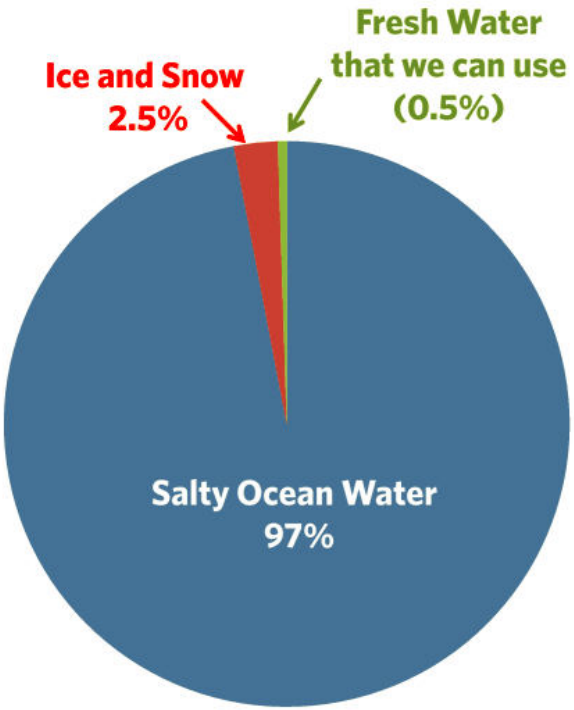
Lesson 1: Part 2

Conservation Solutions: Food

Teachers:

Please put the slides in present mode for best viewing

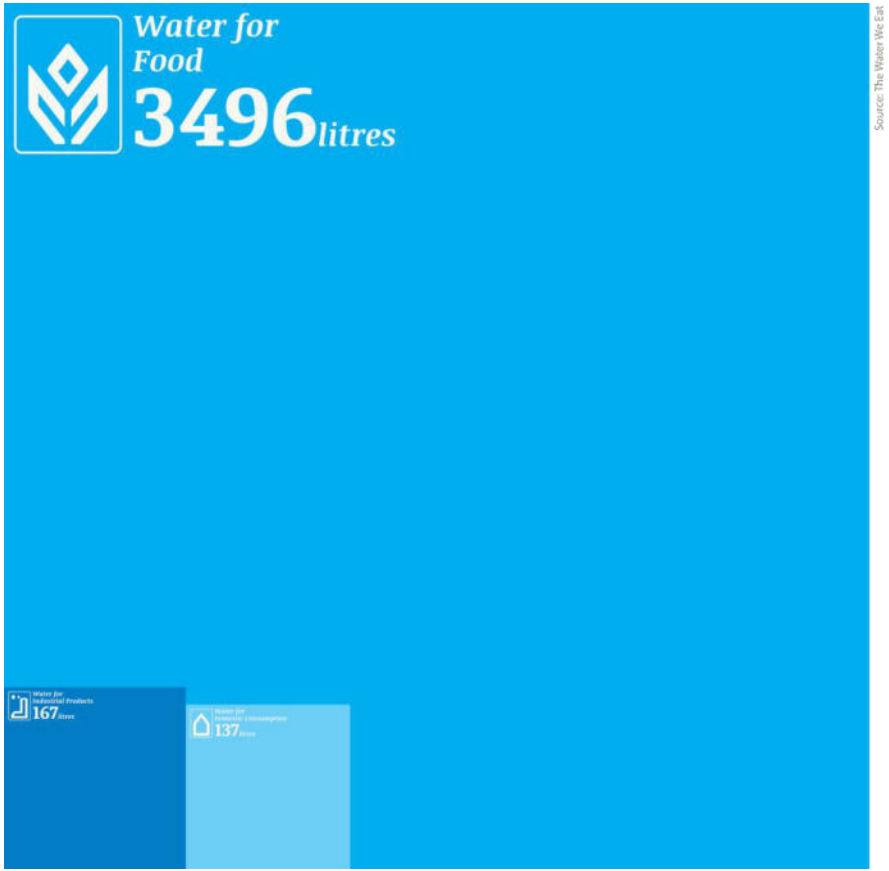
Distribution of Water on Earth



REVIEW from yesterday

SECOND INVISIBLE PART

The second big invisible part is associated with the production of the food we consume. This amounts to **3496** litres per day which means that 92% of the water we use is **invisible** and it is **hidden in our food**!



Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

We call this invisible water **Virtual Water**, a term coined by water guru Prof. Tony Allan. The concept of virtual water helps us realize how much water is needed to produce the goods we use and the food we eat.

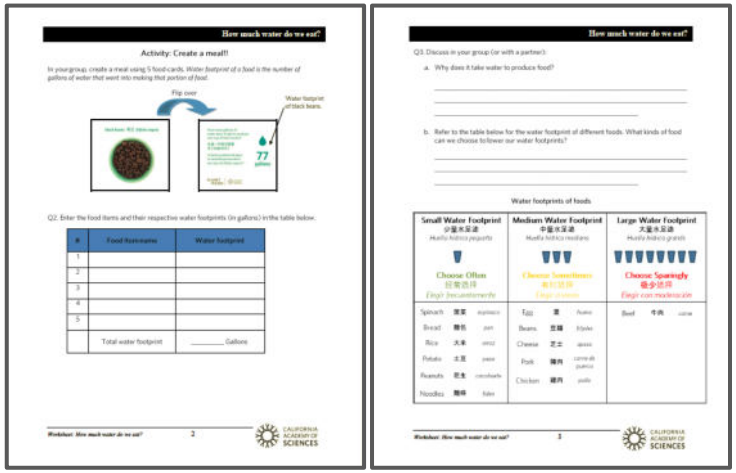
Let's discover why it is invisible.

 Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

Activity: How much water do you eat?

Each Group will need:

- Food Info Cards
- Student Worksheet



After creating a meal, each groups will share out!

Teachers: Chart their responses on the paper provided by Mrs. Jones. Link to additional resources

Teachers: Click here to view full lesson activity plan

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Examples of typical American meals

beef 牛肉 carne
346 Gallons

potato 土豆 papa
23 Gallons

spinach 菠菜 espinaca
6 Gallons

TOTAL: 375 Gallons of Water

chicken 雞肉 pollo
97 gallons

black beans 黑豆
frijoles negros
77 Gallons

rice 米飯 arroz
44 Gallons

TOTAL: 218 Gallons of Water

BEEF: TIME

Consider beef for instance.

In an industrial beef production system it takes on average three years before the animal is slaughtered to produce about **200 kilos** of boneless beef.

Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

BEEF: GRAINS

During the three years the cow consumes nearly **1300 kg** of grains such as wheat, oats, barley, corn, dry peas, and other small grains.

Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

BEEF: ROUGHAGES

The cow also consumes **7200 kg** of roughages such as pasture, dry hay, silage, and other roughages.

Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

BEEF: WATER

The production of all the grains and roughages requires **3060000 litres** of water. We need to take into account also **24000 litres** of water that the cow drinks during the three years and we do not have to forget the **7000 litres** for servicing the farmhouse and for slaughtering processes.

grains and roughages

3060000 litres

drinking

24000 litres

servicing and slaughtering

7000 litres

Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

BEEF: TO SUM UP

Therefore, in total, we need **3091000 litres** of water for producing **200 kilos** of boneless beef. This means that to produce 1 kilogram of boneless beef we need **15400** litres of water.

 Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

A WATER WALL

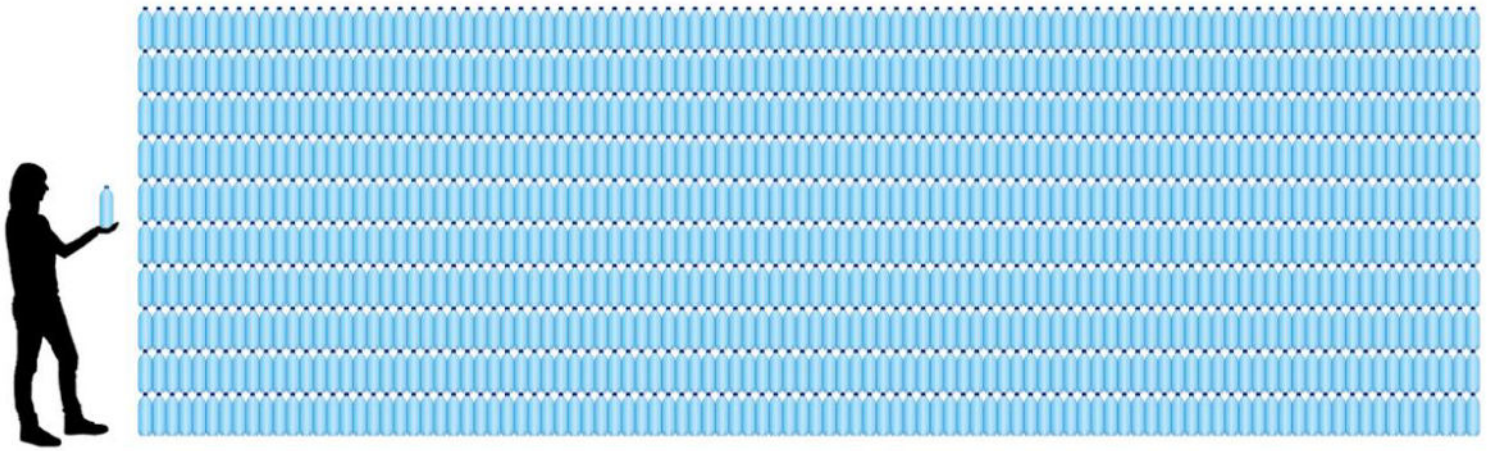
Can you visualize **15400 litres** of water in your head?

Well, if this is a **1-litre** water bottle…

Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

A WATER WALL

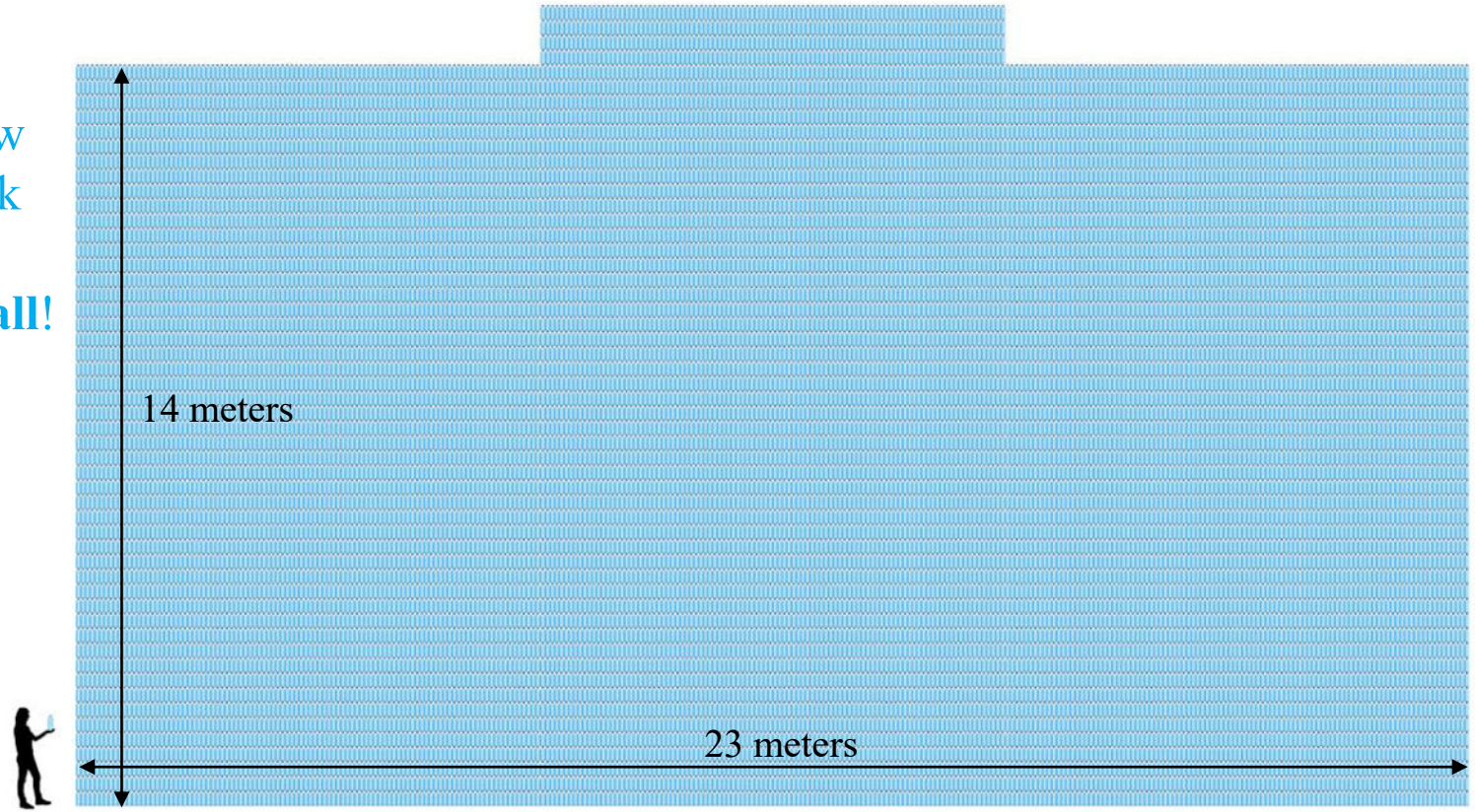
…this is how **1000 litres** look like…



 Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

A WATER WALL

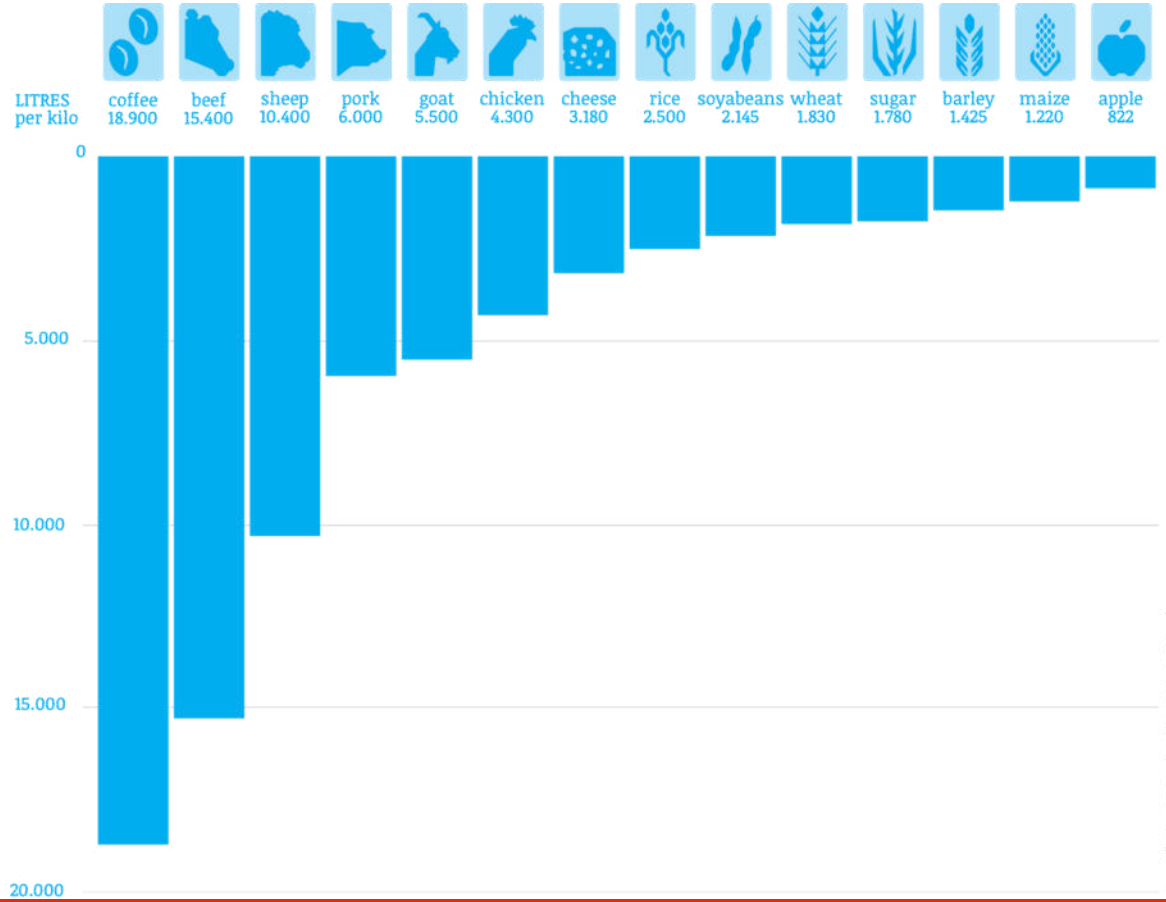
…and this is how **15400 litres** look like, **a 23 by 14 metre water-wall**! All completely hidden in a big steak!



 Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

WATER FOR FOOD

Water is precious. But not just for drinking: **water is food**! Thanks to the extraordinary work of scientists we know how much water we need to produce the food we consume. It is easy to see that some products such as fruit and vegetables are more water-friendly than others.



 Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

So now we know: most of the water we use - 92 % of it - is used in food production. Most of this water is managed by the world's farmers. With the help of science and technology they have performed greater and greater miracles in improving water productivity – in getting more crops per drop.

 Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

Can we help? We can!

The good news is that each one of us can also make the world a little more water secure, ready to face the needs of our peak population future.

How? The answer lies in our shopping baskets.

 Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

THE AMOUNT OF MEAT

The amount of meat in our diet is crucial! The average daily water consumption of a meat-eating person is 5000 litres of water per day. The average for a vegetarian is 2500 litres. In countries where there is a culture of heavy meat consumption, the advice is: one meat-free-day a week! Every little bit helps.

 Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

THE TYPE OF MEAT

The type of meat we consume is crucial! Choose meat raised on grass if you can. It is normally a more sensible use of water resources, since the land often cannot be used for highly productive crop production. Meat from sheep almost always falls into this category. Agri-corporations and supermarkets do not generally fit the grass-fed livestock model. Cheap meat is usually fed on grain, corn-fed beef is the problem.

 Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

THE FOOD WE WASTE

The food we waste is crucial! We are highly wasteful, particularly in the industrialized nations. In the advanced economies we throw away approximately 30% of the food we purchase. Almost a third! And with it, all the water resources we use to produce that food. It would be wise to consider whether we should be producing and buying that food in the first place, so please, do not waste!

Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

DON'T FORGET

1

one meat-free-day
a week

2

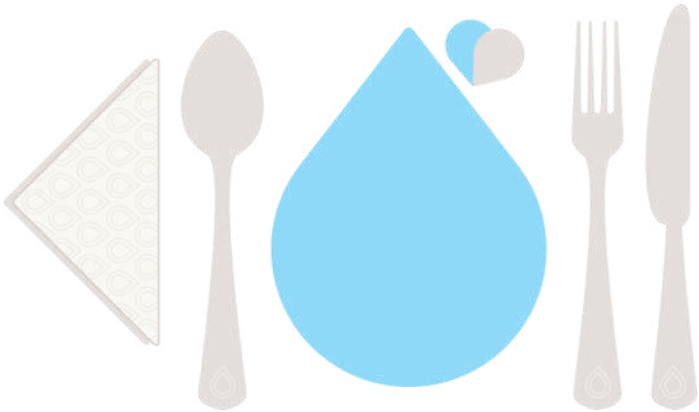
choose meat
raised on grass

3

do not waste
food

 Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

A SENSIBLE DIET



Enjoy a water sensible diet!
Help make a water conservation pledge!

Due by Friday:

Water Footprint Calculator

Teachers: This has already been posted on your Google Classroom for your students!

Source: The Water We Eat .com. | Data: Water Footprint Network, Virtual Water by Tony Allan

Today, we will take a class water pledge and an individual water pledge!

Teachers: Click here for the class water pledge!

Students: Check Google Classroom and complete your individual pledge by Friday!

CREDITS

This work is labor of love and passion for an important cause.

If you use this material, we would be grateful if you could credit us.

We would be over the moon to receive a photo of you with your class while using the infographic or this teaching material:
post@infodesignlab.com

@@InfoDesign_Lab @angelamorelli @tomhal99

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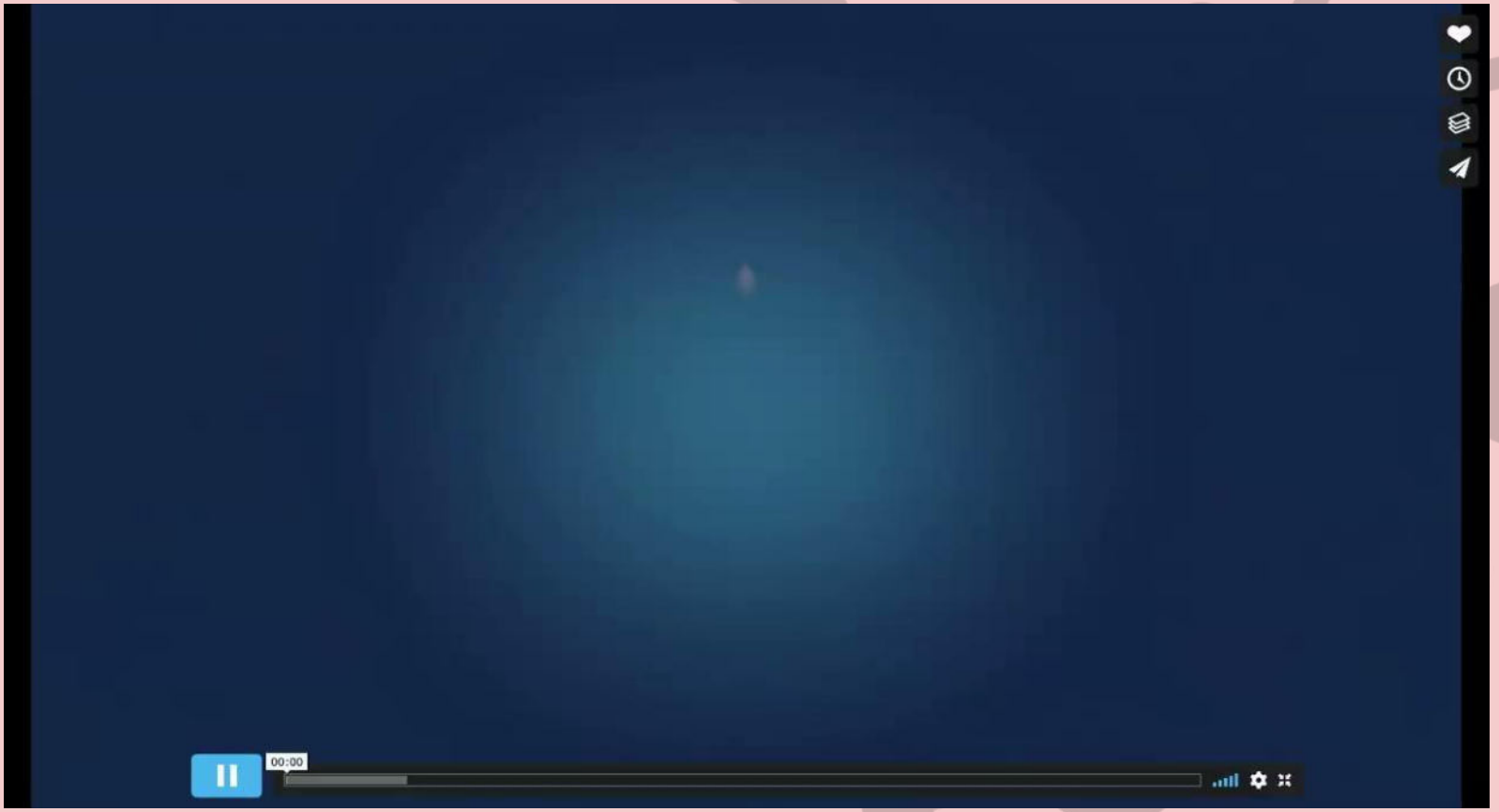
GRADE 5
MODULE 3
DQ5

H2O Response Team: Water Around the World

Wednesday, April 6th

Watch first for background knowledge!

Link for video if it doesn't work

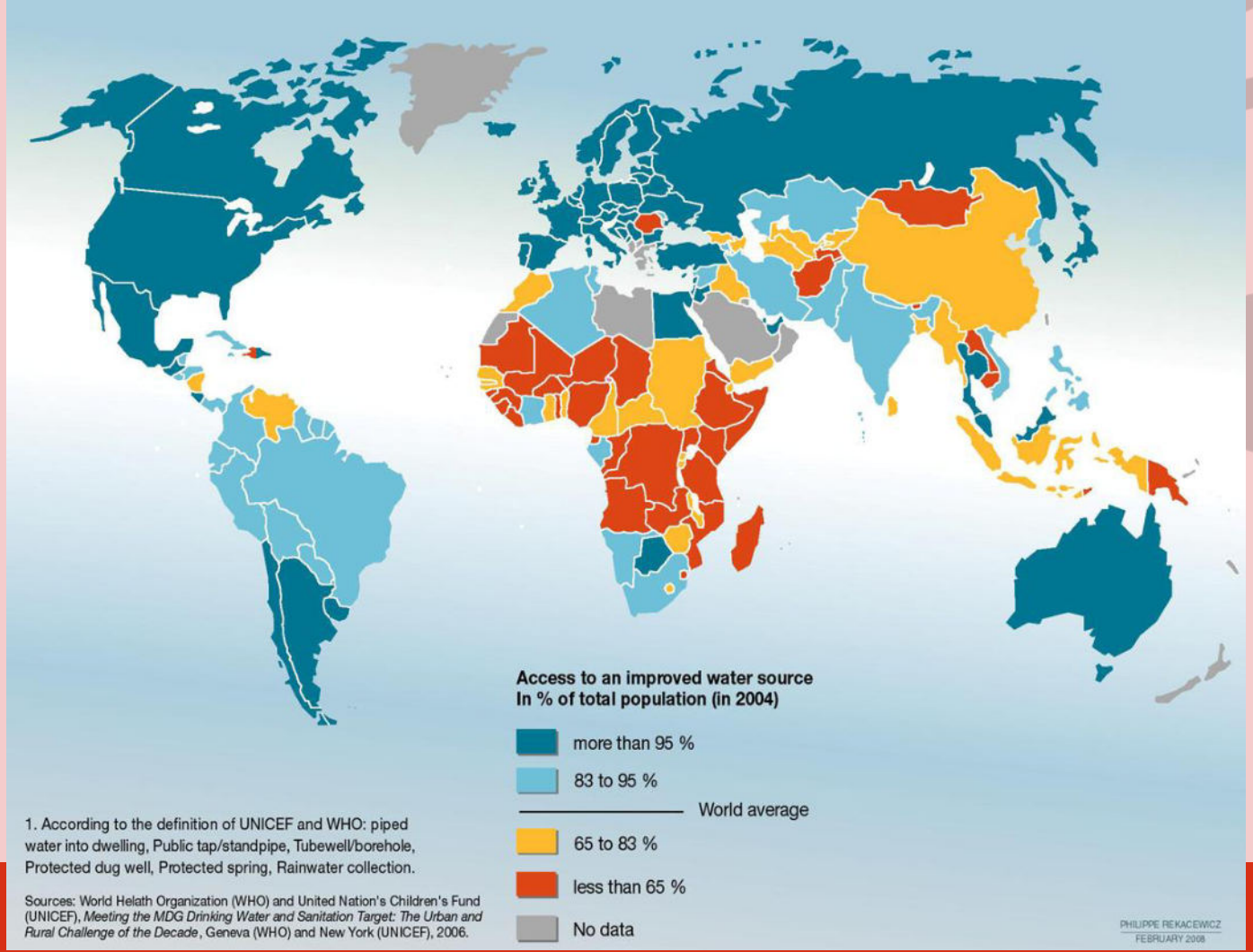


After viewing the map:

What do you notice?

What do you wonder?

Keep these noticings in mind as you continue onto the activity!



Activity: Water Survival Activity

Materials Needed per Group:

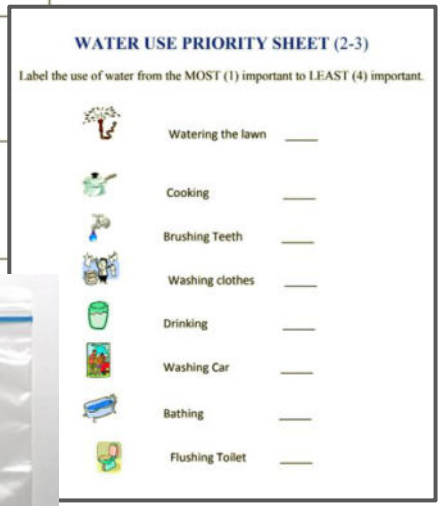
1. 1 Priority Sheet (Usages of Water)
   - Add your group # and names

2. 8 Labels for water priorities

3. 4 Ziploc bags - one labelled CANADA and one labelled NICARAGUA, included “polluted”

-There are about 65 [redacted] the Canada bag and 12 in Nicara[redacted]a bag.

[redacted] = water supply*



Teachers: When groups have their materials, please continue to the next slide.

**The worksheet will say jelly beans, but Mrs. Jones was not able to purchase over 1500+ jelly beans for this activity, so we are using blue squares of paper.*

Activity: Water Survival Activity

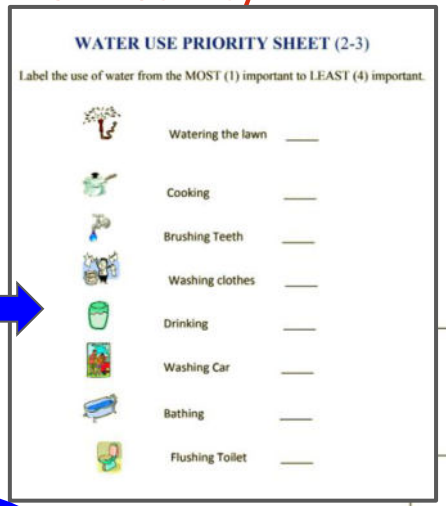
After gathering materials, follow the next steps below as a group:

1. Using the “Priority Sheet” groups rank the MOST important use of water to the LEAST important use of water.

2. Line up the bags with the Water Use Priority labels (drinking, cooking, bathing, etc.)

3. Put 5 [redacted] rom the water supply of both the Canada and Nicaragua bags aside in the “Polluted” bag for Canada & Nicaragua – these are POLLUTED water- mark the [redacted] with an X.

STUDENTS: You should only use your polluted water if absolutely necessary.



Activity: Water Survival Activity

Keeping in mind the Daily Life Requirements for Water Use,

Students: decide as a group where to put their water supply for N[redacted]ragua.

Remember, *you may not have enough to meet the Daily Life Requirement*. You may be forced to use POLLUTED water. If you have extra, *you may disperse your water to other activities (brushing teeth, washing clothes, etc.).*

Then, set aside your Nicaragua water and disperse your water supply of Canada following the steps above.

Teachers: After students complete both distributions for Canada & Nicaragua, proceed to the next slide!

The Daily Life Requirements for Water Use:

Drinking – 5 [redacted]

Cooking – 5 [redacted]

Bathing – 5 [redacted]

Students:

As a group, please put **all materials back into the main ziplock bag.** There was a TON of prep involved in making this activity and we would like to be able to reuse these sets next year!

Activity: Water Survival Activity

Thinking back to your water supply…

Discuss as a class:

- What was the MOST important Daily Task and use of water? What was the LEAST important use of water?
- How was Canada's water supply different than Nicaragua's water supply?
- How did it make you feel when you had enough beans for all your Daily Tasks?
- How did it make you feel when you didn't have enough beans for all your Daily Tasks?
- What did your group do when you didn't have enough water? Is it safe to drink the polluted water?

Teachers: Please collect group bags of materials & save for next year

If you have time, please continue onto the next slides to view real world situations with our realities of water around the world…take notice of their water in the photos…

Water Inequality Photos Put Privilege Into Perspective

Niger: Family of Five Uses 60 Liters per Day

Niger is West Africa's largest country, but is also one of the least developed. There, 8 million people lack clean water, according to WaterAid.

While the Mahamadou family feels fortunate to live in a village near the Niger River, they're aware that the source is contaminated. They use a stone to filter the water, but that doesn't necessarily protect them. Mariama, mother of three, contracted cholera two years ago, according to UNICEF.

A number of nonprofits are working in the region, including WaterAid, which provided 10,000 people with clean water last year.

Water Inequality Photos Put Privilege Into Perspective

U.S.A., Family of Three Uses 1,000 Liters per Day

Ashley Gilbertson, the photographer behind the World Water Week series, lives in the West Village in New York City with his wife, 6-year-old son and dog, and consumes 1,000 liters of water a day.

“I’m shocked by the amount of water my family uses in New York,” Gilbertson told UNICEF. “I knew it would be significantly more than in some of the countries I travelled to, but not by this much.”

He told UNICEF he was most despondent about the way climate change has dried up water sources and how women are often forced to spend their days doing the arduous job of collecting water for the family.

The average American family of four uses 400 gallons of water per day (about 1,500 liters), according to the Environmental Protection Agency.

Water Inequality Photos Put Privilege Into Perspective

Za'atari Refugee Camp, Jordan, Family of Six Uses 380 Liters per Day

As of April, there were about 83,000 people living in the Za’atari refugee camp in Jordan, and 35 percent of its water was being trucked in, according to UNICEF.

Since fleeing Syria in 2012, the Abu Noqta family, which includes father, Abdulrahman, mother, Masamah, and their four children, has been very conservative with water consumption. They recently purchased a water tank, which camp authorities fill up every five days.

“We’re very economical with our water because we don’t have enough," Masamah told UNICEF. "We’re afraid that someday we will not have water because sometimes the water trucks go on strike."

Together with Mercy Corps, UNICEF is working to build wells to minimize the need to rely on outside sources.

Final Reflection

Discuss as a class:

- What are some ways you can conserve and protect water?
- Do you think water is a human right? Why?

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MODULE 3
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H2O Response Team: Engineering Water Pipes

Special Guest: Mr. Pressley from Teichert Construction
Mrs. Jones' Class 10:45-11:15
Mr. Paulsen's Class 12:45-1:15
Ms. Johnston's Class: 1:20-1:50

Friday, April 8th *Work time for students after presentation

Key Learning Objectives

Students will be able to

- Analyze models to determine patterns and trends facing the water Industry.

- Differentiate between commonly used pipe materials used to transport water.

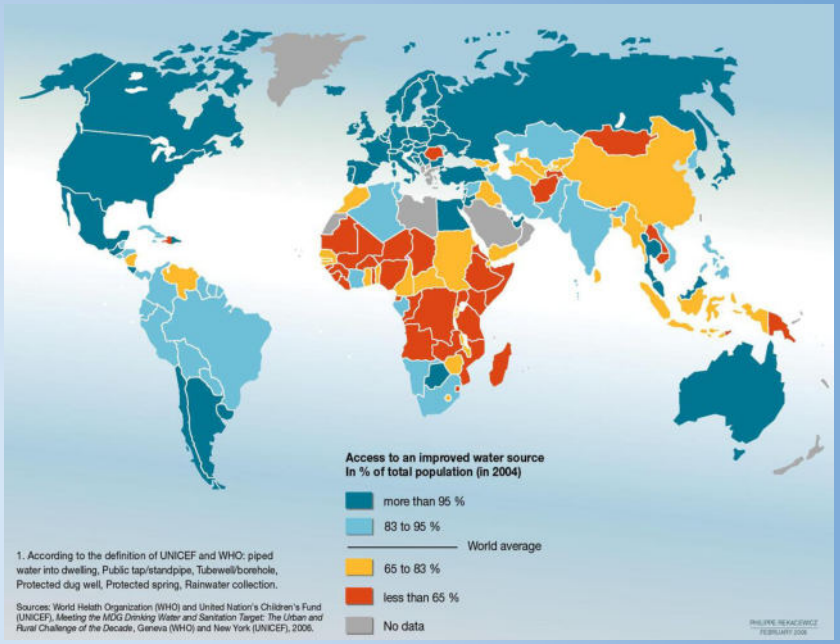
- Construct a plan to replace aging water pipes and monitor water loss and contamination.

Teachers: Please present these

BACKGROUND

According to the United Nations Sustainable Development Goals:

- 26% of the world's population lacks access to clean drinking water
- 46% lacks access to safely managed sanitation.



While these numbers might seem distant for many, it is an issue that continues to impact those living around the world and in the United States.

Think back to our water map and Nicaragua

Teachers: Please present these

American Society of Civil Engineers 2021 Infrastructure Report Card:

- That there is a water main break **every two minutes**
- An estimated **six billion gallons of treated water lost each day**, which is enough to fill over 9,000 swimming pools!

The United States drinking water infrastructure uses over **two million miles of underground pipes** to deliver water safely to Americans.

BACKGROUND: **Teachers:** Please present these

Unfortunately, our **water infrastructure** is aging.

What exactly is infrastructure?
Infrastructure is how our goods are delivered, our supply chains connected, and our health and safety protected.

Bridges, roads, power plants, and pipes are examples of infrastructure

These are the ***necessary structures and systems that serve as the backbone of our economy and quality of life***.

Teachers: Please present these

Wastewater treatment facilities and drinking water systems are **all approaching the end of their design lives**, which is approximately 100 years.

How does this affect *<u>us</u>*?

- Water main breaks cause disruptions to our economy

- Leaking pipes can allow potentially harmful contaminants into our drinking water.

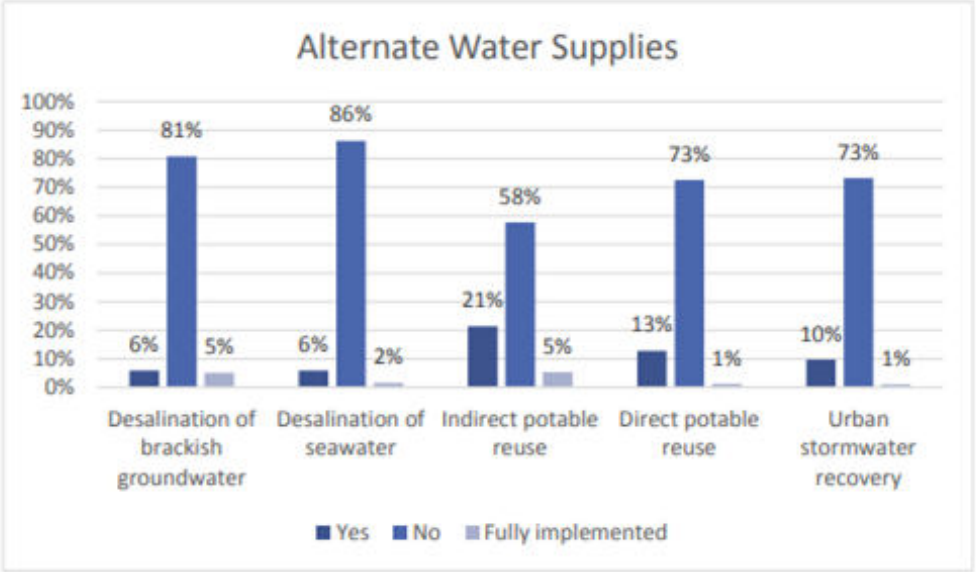
Teachers: Please present these

Water Sustainability Reports

Review the reports and charts:

- What do you notice?
- What do you wonder?
- *What makes you think that?*

Figure 13. Responses from utility personnel regarding whether their utilities are considering augmenting water supplies with desalination, reuse, and/or stormwater recovery (n = 685)



Note: Percentages reflect utilities considering augmentation method only if applicable.

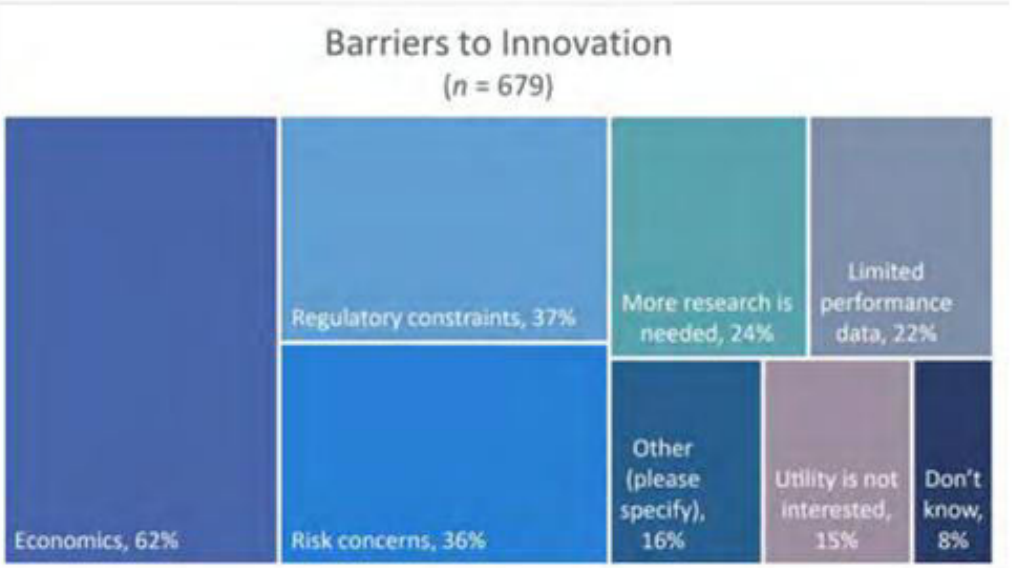
Teachers: Please present these

Water Sustainability Reports

Review the reports and charts:

- What do you notice?
- What do you wonder?
- *What makes you think that?*

Figure 15. Opinion of utility personnel on barriers to innovation (n = 679)



Other (please specify) – Culture of Innovation

When asked if there were any barriers to innovation not listed, a large number responded with the following:

"Innovation is not actively encouraged."
"Lack of innovative thinking."
"Need more openness to new ideas from new employees and other agencies."
"[Our] utility is innovative and incorporates that mindset into the utility culture."
"Limited resources (personnel/time) to pursue innovation."

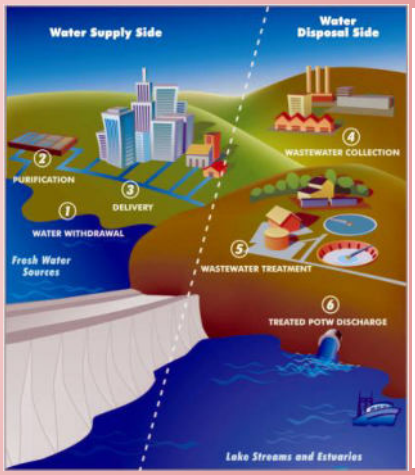
Teachers: Please present these

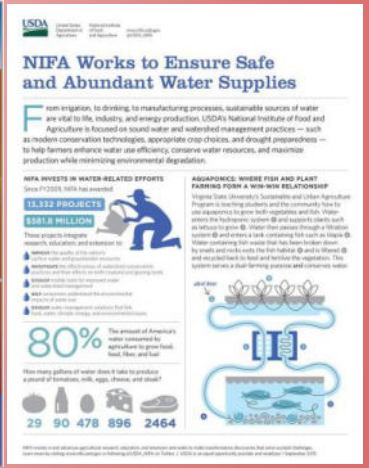
According to the United Nations…

129 countries are <u>not</u> on track to have sustainable managed water resources by 2030

Sustainable Water Management

However, more than 178 countries have adopted a comprehensive plan of action to ensure availability and sustainable management of water and sanitation for all.





Teachers: Please present these

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Let’s be part of creating a solution!

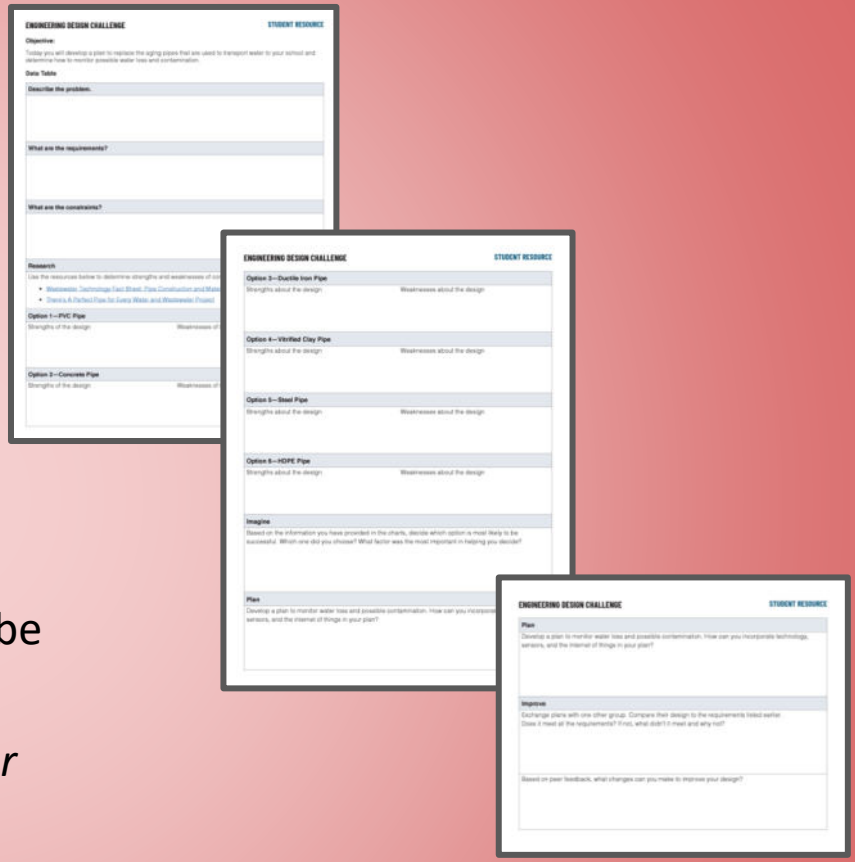
Today you will:

- Develop a plan to replace the aging pipes that are used to transport water to your school
- Determine how to monitor possible water loss and contamination

Teachers: Please present these

Students will need:

- Engineering Design Challenge Handout
- Pencil
- Clipboard (if joining down on the carpet)



Let's explore the different types of pipes that can be used!

*As Mr. Pressley presents, *you'll need to write your notes in on your handout!*

Teachers: Please present these

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Mr. Pressley

Teichert Construction
Project Engineer
Greater Sacramento Area

Mr. Pressley will present

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Option 1—PVC Pipe

Strengths of the Design

- Cost Effective
- lightweight
- Can hold pressures up to 350 psi

Weakness of the Design

- Brittle
- If exposed to sun >1 year, can be unuseable

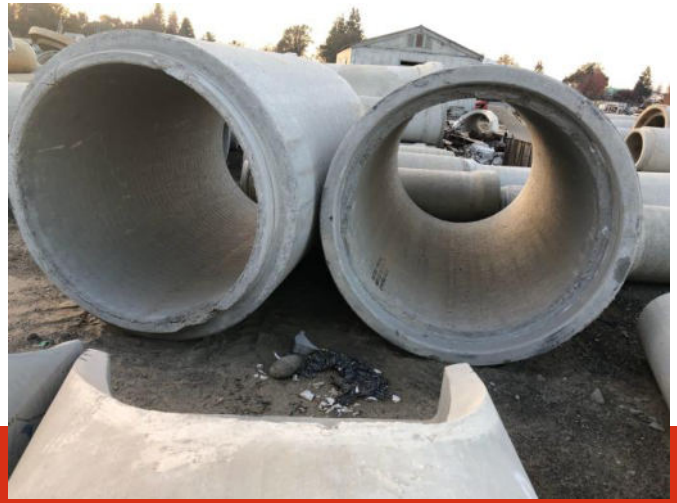
Option 2—Concrete Pipe

Strengths of the Design

- Strong once installed
- Good corrosion resistance

Weakness of the Design

- Very heavy
- Made with porous material
- Can’t hold high pressures



Option 3—Ductile Iron Pipe

Strengths of the Design

- Can hold pressures up to 350 psi
- Long lasting if protected correctly
- Stronger than PVC

Weakness of the Design

- More expensive than PVC
- Can be very corrosive to different soils
- Heavier than PVC

Option 4—Vitrified Clay Pipe

Strengths of the Design

- Long lasting to all soil types

Weakness of the Design

- VERY brittle
- Material inconsistent
- Minimal Manufacturers
- Not typically used for clean water (mostly used with waste water materials)

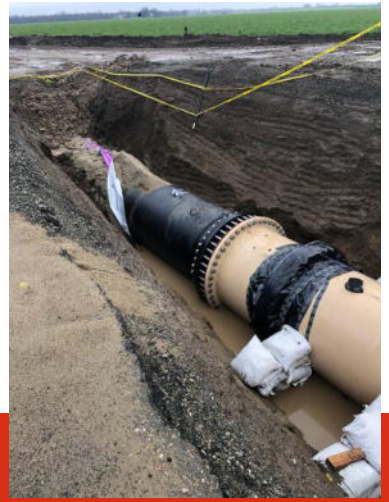
Option 5—Steel Pipe

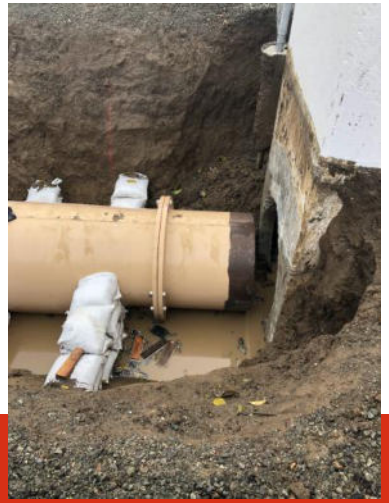
Strengths of the Design

- Long lasting once installed & protected
- Can be used in instances other pipe types can't
- Allows for high pressure

Weakness of the Design

- Very expensive
- Typically needs to be welded together
- Very heavy





Option 6—HDPE Pipe

Strengths of the Design

- Holds up to 350 PSI
- Very versatile material
-

Weakness of the Design

- Need machine to fuse together
- Pipe is heavy
- Newer material to pipe market

Any questions for Mr. Pressley?

Please thank him for coming today!

Now, students: Please get your chromebook- the slides that Mr. Pressley presented (and that you took notes on) are posted on your Google Classroom!

Get ready to problem solve and work collaboratively using the new knowledge you have learned!

Teachers: Please present

Discuss & Complete on your Handout…

Imagine:

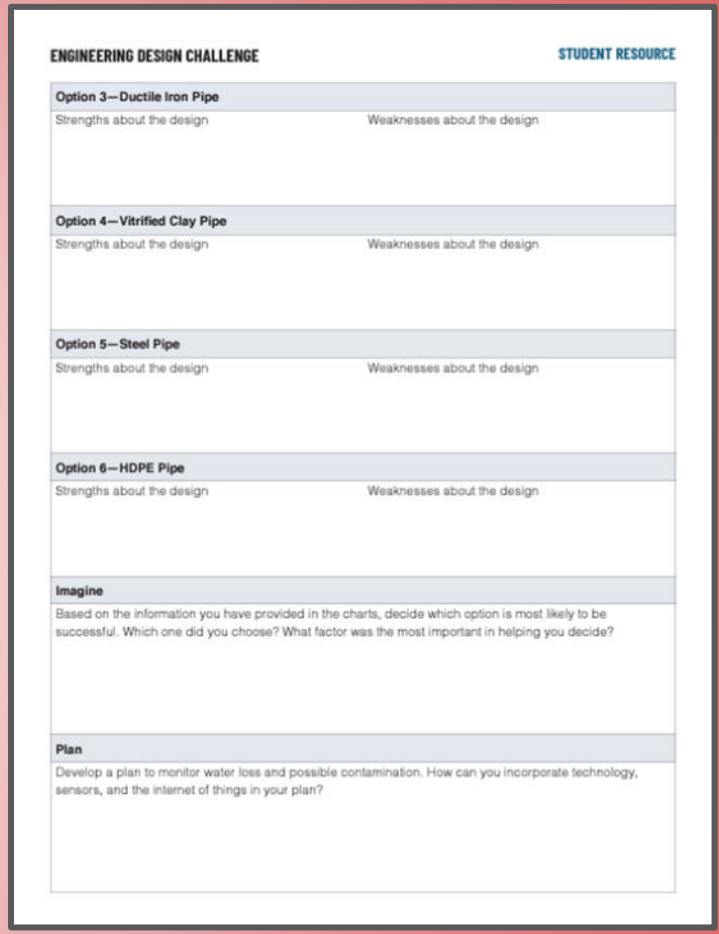
Based on the information you have provided in the charts, decide which option is most likely to be successful.

- *Which one did you choose?*
- *What factor was the most important in helping you decide?*

Design & Plan:

Develop a plan to monitor water loss and possible contamination.

- *How can you incorporate technology, sensors, and the internet of things in your plan?*



ENGINEERING DESIGN CHALLENGE — STUDENT RESOURCE

Option 3—Ductile Iron Pipe	
Strengths about the design	Weaknesses about the design
Option 4—Vitrified Clay Pipe	
Strengths about the design	Weaknesses about the design
Option 5—Steel Pipe	
Strengths about the design	Weaknesses about the design
Option 6—HDPE Pipe	
Strengths about the design	Weaknesses about the design

Imagine

Based on the information you have provided in the charts, decide which option is most likely to be successful. Which one did you choose? What factor was the most important in helping you decide?

Plan

Develop a plan to monitor water loss and possible contamination. How can you incorporate technology, sensors, and the internet of things in your plan?

Teachers: please present these

IF TIME…Discuss & Complete with other Teams

Complete the Final Section of your Handout while discussing

Improve:

Exchange plans with one other group. Compare their design to the requirements listed earlier.

- *Does it meet all the requirements?*
- *If not, what didn't it meet and why not?*
- *Based on peer feedback, what changes can you make to improve your design?*

Teachers: Please present these

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