Penn Brook School Water Conservation Program
Grade 3 Curriculum
Paulette Morin, Instructor
Paul Lauenstein, Water Conservation Coordinator

May 22, 2013

Lesson 1
The World's Water and Georgetown's Water

Students will know:

- **Water is our most precious natural resource. Without water, nothing else is possible.**
- **Where the earth's water is and how little of it is available to people.**
- **Where Georgetown's water comes from.**
- **How water is delivered to homes and businesses in their community.**
- **The purpose of a water meter, what it looks like, and how it can be used to detect leaks.**
- **How to compute average daily water use per person for a household from a water bill.**

Students will be able to:

- **Describe the finite and essential nature of fresh water in general terms.**
- **Use a town map to locate the Parker River, ponds, town wells and tanks.**
- **Explain how local wells supply homes and businesses with fresh water.**
- **Describe how water comes to and exits their home from wells/pipes/drains etc.**
- **Calculate average household water use from a Georgetown water bill (homework).**

Materials:

- **Name tags**
- **Video "Water uses and Abuses" (first 5 minutes only)**
- **Google Earth projected onto large screen**
- **Inflatable globe**
- **Gallon jug of water and a clear plastic cup with a line marking the level of 1.28 ounces)**
- **12 large laminated maps of Georgetown**
- **Water meter, bucket with lid and funnel, and a jug of water**
- **Georgetown sample water bill projected onto large screen**
- **Glossary**
- **Water conservation song with audio and sheet music**

Introduction

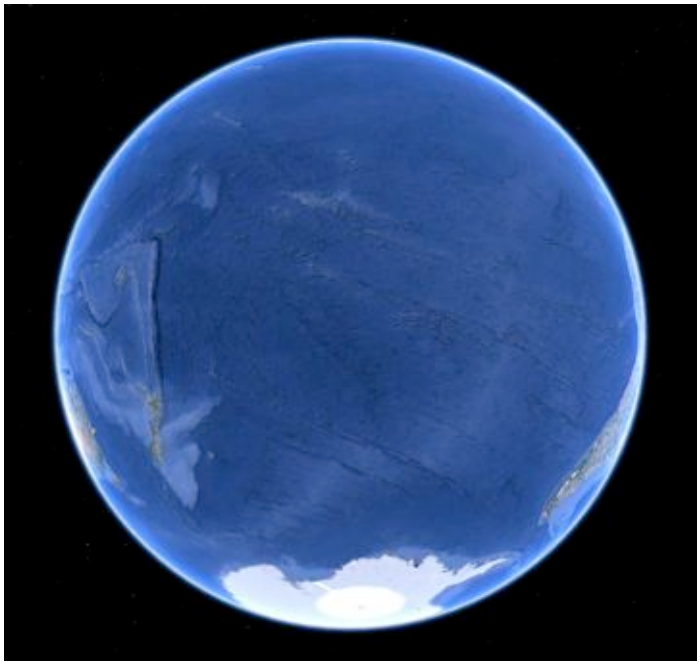
Hi! My name is Paulette Morin. I am your water conservation instructor. This is Paul Lauenstein, the water conservation coordinator for Georgetown. Together, we are going to learn about water in four classes over the next few weeks.

Even though we tend to take it for granted, water is our most precious natural resource. Without water, nothing else is possible. We are going to learn where the earth's water is and how little of it is available to people. We'll also learn where Georgetown's water comes from, and why it's important not to waste it.

Now we are going to watch a 5-minute video that will give you an idea about how many ways water is useful and necessary.

1. Show video "Water Uses and Abuses" (only first 5 minutes.)

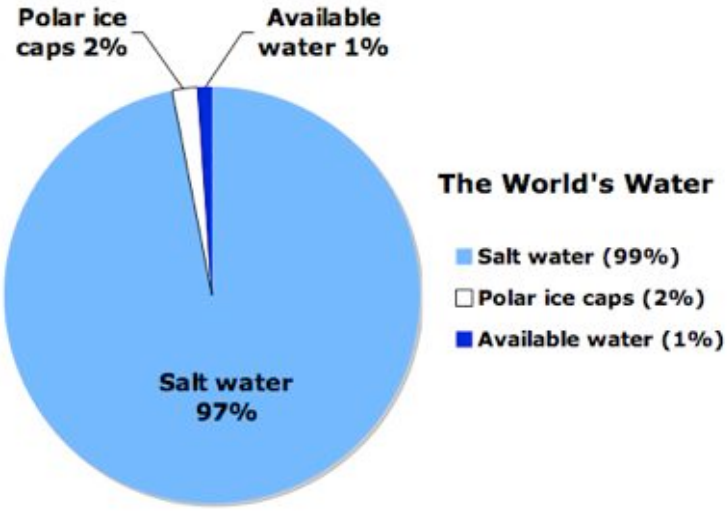
2. Show students image of the Earth from space using Google Earth.



   Match Google Earth image with inflatable globe.
   Discuss how we can use the globe to see how much water and land there is.
   70% of the earth's surface is covered by water.
   Show how the Pacific Ocean covers half the earth.
   Show how far away the polar ice caps are.

3. Distinguish between bodies of salt water and fresh water and usable vs. non-usable water. Emphasize that although the earth appears to have a lot of water, the amount that people can actually use is very small. Have students discuss why.

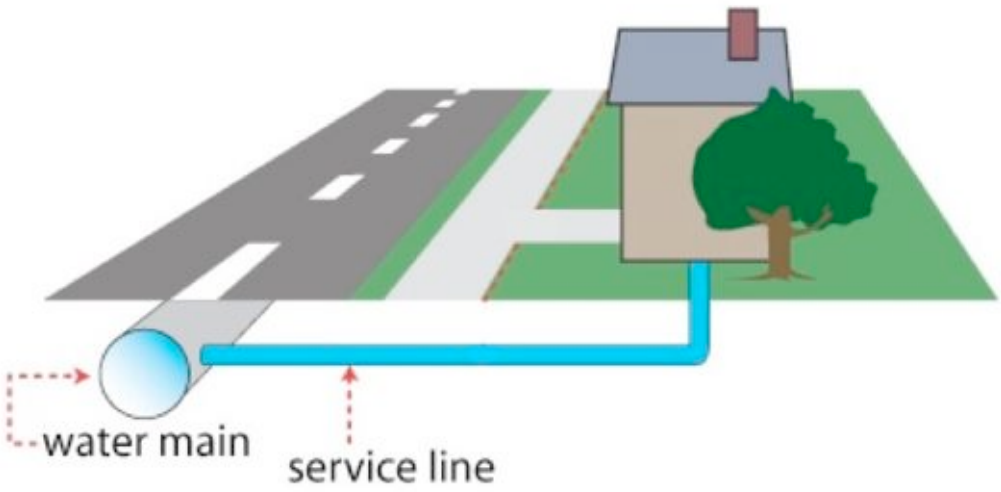
4. About 97% of the earth's water is salt water in the oceans. (PowerPoint graphic of pie chart).



We cannot drink salt water, and we cannot use it to grow crops. About 2% of the earth's water is frozen in glaciers and the polar ice caps that are too far away for people to use. Less than 1% of all the water in the world is unfrozen fresh water that is not too deep in the earth's crust to reach with wells.

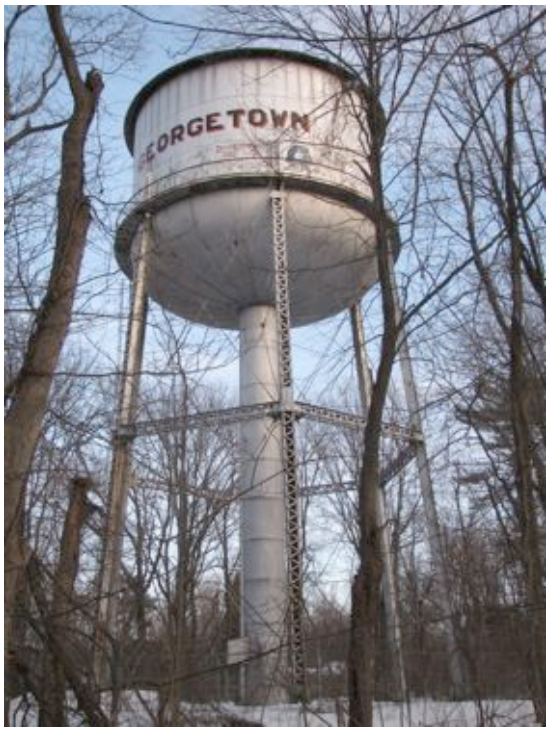
Demonstration
Imagine that the water in a 1 gallon water jug represents all the water in the oceans. Pour 1% of the gallon (= 2.5 tablepoons) into a clear plastic cup, and show how little it is compared to the rest of the water remaining in the gallon jug. The water in the cup represents all the fresh water in the world.

5. Where does the water in your house come from? (PowerPoint water main graphic)



Hand out laminated town maps (PowerPoint of Georgetown map).

Point out the tiny dots along the roads on the map. They represent houses.
Water pipes follow roads from the water tanks to the houses. (PowerPoint of tank).



Find the tanks on the map. Why are the tanks up high? (Answer: so the water will flow by gravity from the tanks down to the houses).
Why do the water pipes follow the roads? (Answer: Houses are located by the roads. Also, sometimes water pipes leak. It's easier to find leaking water pipes and fix them if the pipes are located along the roads. Fixing leaks saves a lot of water!)

(PowerPoint photo of well pump)

Where does the water come from to fill the tanks? (Answer: Georgetown has three wells that pump water up to fill the water tanks). Find the wells on the map.

6. Have students brainstorm uses for water (irrigation/farming, safety purposes such as firefighting, factories and stores, household use, etc.). Discuss.

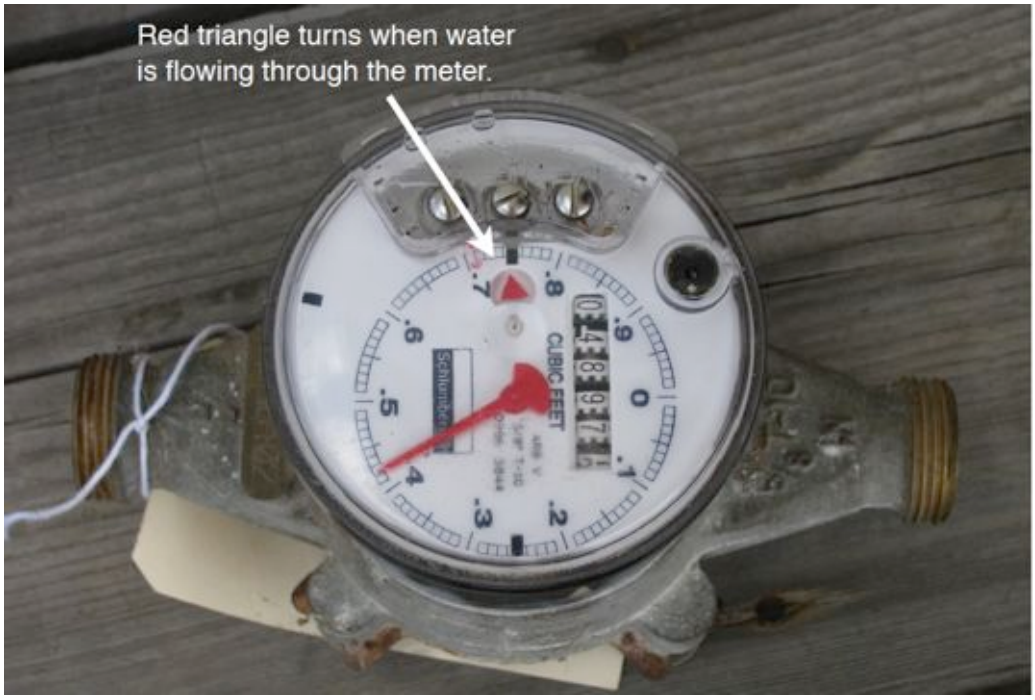
   What kinds of things do we use water for inside the house? (toilets, showers, washing clothes and dishes, tooth brushing, cooking).

   How about outside? (watering lawns, washing cars, kayaking, swimming, washing pets, etc.)

7. Wildlife living in the Parker River watershed needs water too (PowerPoint pictures of herring, beaver, raccoon, heron, salamander, baby turtles).

Every time we turn on the water, we take water away from the environment.

8. Every house has a water meter. (PowerPoint photo of water meter with callout)



A water meter measures how much water goes into your home. Why is that important? (Answer: The water meter measures how much water your family uses, and the Water Department sends your parents a bill for that amount every 3 months. Water is NOT FREE. You must pay for every gallon you use.)

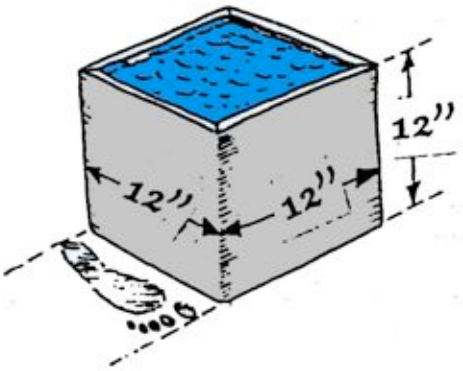
The water meter is usually located in the basement. Why not outside? (Answer: so it won't freeze in winter).

9. **Water Meter Demonstration**

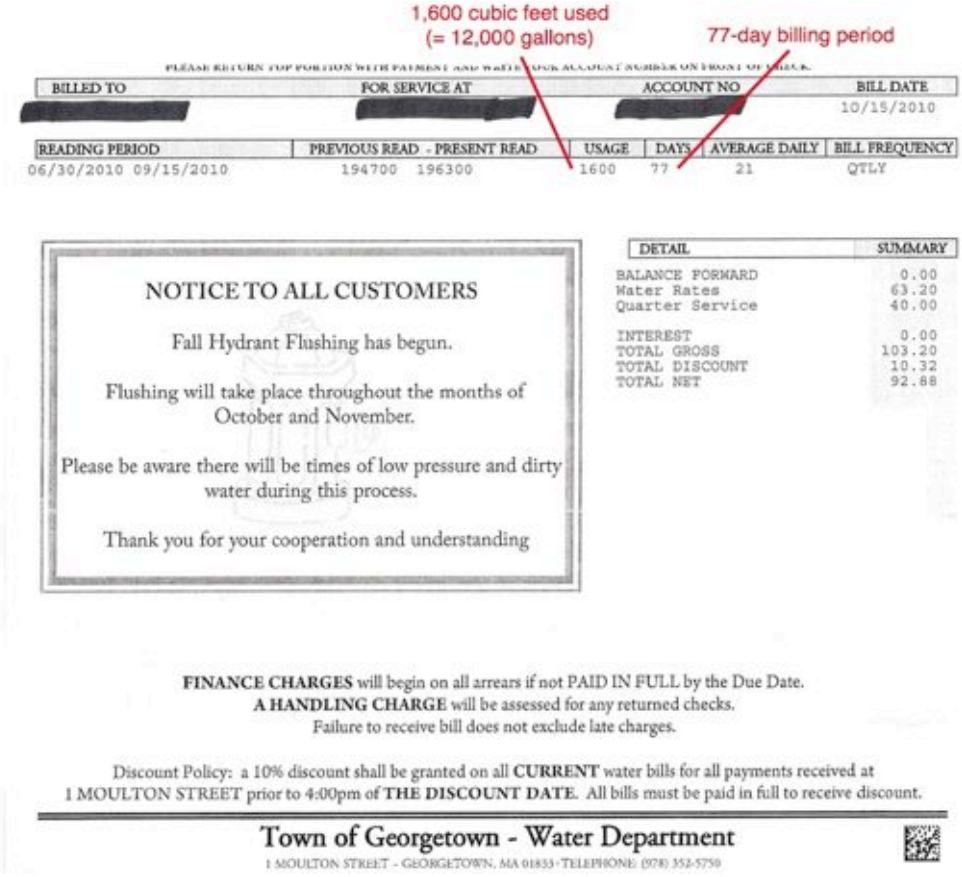
Have the students gather around the water meter and show them the little red triangle that turns when water is flowing through the meter. Then pour some water through a funnel into the meter so that everyone gets a chance to see the red triangle turning when water is moving through the meter.

In most homes, the water meter is in the basement. When the red triangle is turning, water is flowing somewhere in the house. If the red triangle is turning while nobody is using water, it usually means there is a leak.

10. Water meters measure how much water you use not in gallons but in cubic feet. How many gallons are in a cubic foot? Seven and a half gallons (PowerPoint graphic).



11. How much water does a person need daily? You can calculate how much water you use each day from your water bill. Let's find out how to read a water bill and figure out how much water is used by this family from their water bill. (Show PowerPoint of a water bill and do the math on the blackboard.) If you save money by using less water, will you have more money for other things?



12. The average family in Georgetown uses about 60 gallons of water per day per person, but some use much less. Review water bill homework lesson. This will be a project for you to do this week with a parent. Show them what you have learned about water bills and household water use. Bring in your results next week.

Glossary words:

glacier, polar ice cap, drains, water meter, irrigation

Sing Water Conservation Song

Assessment:

Ask: How much of the world's water is available for our use?
(Answer: available fresh water is less than 1% of the world's water.)

Ask: Where is the other 99%?
(Answer: the rest is seawater (97%) that is too salty to drink, or glaciers and polar ice caps (2%) that are too far away.)

Ask: Where does our fresh water come from in Georgetown?
(Answer: three wells.)

Ask: Where does the water from the wells go next?
(Answer: three storage tanks.)

Ask: How does it get to our houses from the tanks?
(Answer: it flows from the tanks through pipes beside the roads to our homes.)

Ask: Why are the pipes located along the roads?
(Answer: because the houses that need the water are located along the roads. Also, it's easier to find leaks and fix leaking pipes if they are located along the roads.)

Ask: How do we measure water that comes into our homes?
(Answer: water meters. That's how the Water Department knows how much money to charge us for the water we use.)

Ask: How much water does each person in Georgetown use every day, on average?
(Answer: 65 gallons. That's a lot of water every day! You will find out how much water you use in your homes every day when you do the homework. Will it be more or less than 65 gallons per person per day?)

Public Service Announcement:

After the four water conservation lessons, we will be making a Public Service Announcement (PSA) for Georgetown's local cable television. We will be working on this project during our last class. We will be meeting at the Middle High School Auditorium on an evening in May, shortly after we finish this program at the end of April.

Every Penn Brook third grader is invited to come and sing the Water Conservation Song together. A few students from each class will be invited to say something that they learned during this program. This is a very important part of this project because YOU get to tell the community what we learned about water conservation and how everyone in Georgetown can

help conserve it. Start thinking about what you might say to convince other people in Georgetown to save water! It will be lots of fun and you will get to see yourself on Cable TV singing our Water Conservation Song!

Ready for next lesson!

GWCP Paulette M. Morin

Penn Brook School Water Conservation Program
Grade 3 Curriculum
Paulette Morin, Instructor
Paul Lauenstein, Water Conservation Coordinator

May 30, 2013

Lesson #2
Groundwater Aquifers and Faucet Aerators

Students will know:

- **Georgetown is in the Parker River watershed.**
- **Georgetown's water comes from groundwater aquifers near the river.**
- **Well pumping can adversely affect rivers.**
- **Conserving water reduces well pumping.**
- **How to install a low-flow faucet aerator, and how much it can save.**

Students will be able to:

- **Explain what a groundwater aquifer is, and how we get water from it.**
- **Describe in general terms how the water system in Georgetown works, where Georgetown's three wells are located, and why.**
- **Explain the effect of well pumping on a nearby river.**
- **Measure the flow from a bathroom faucet in gpm.**
- **Take home a low-flow faucet aerator for family use and explain how to exchange it for a new one (home project).**

Materials:

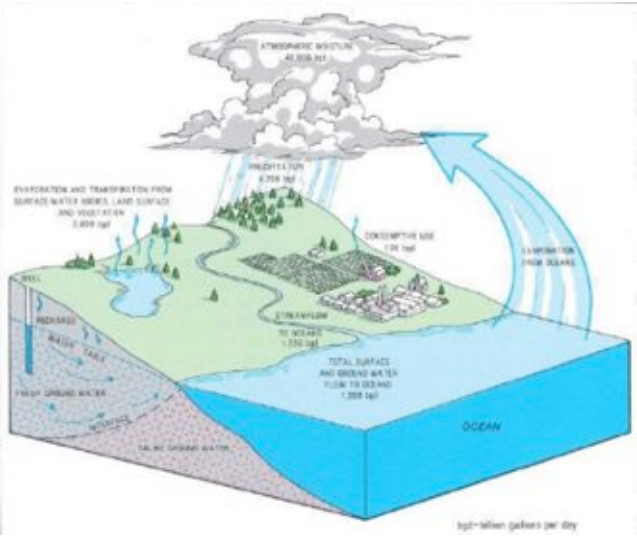
- **Name tags**
- **3 minute groundwater video**
- **12 laminated maps of Georgetown and 12 of the Parker River watershed**
- **Groundwater/Aquifer model, several gallons of distilled water and flashlight**
- **Sponge, bucket and small pitcher of water**
- **Low-flow aerator and a classroom sink fitted with a high-flow aerator, jar opener and/or pliers, and three gallon jugs.**
- **141 low flow (0.5 gpm) aerators (one per student & teacher) for home project**
- **Letter from Principal Tanner and instructions for measuring faucet flow and installing a low-flow faucet aerator in a home bathroom sink.**
- **Glossary**
- **Water conservation song with audio and sheet music**

Collect the water bill surveys, and announce that they will be tallied up and reported at the next class on June 10.

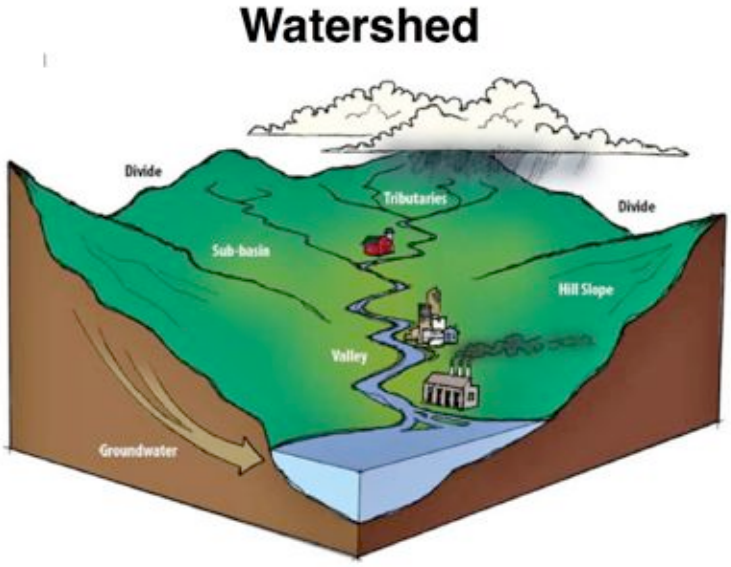
Watch 3 minute groundwater video. (optional)

<u>Where does Georgetown's water come from?.</u>

Last time we found out that Georgetown gets its water from three town wells.
(PowerPoint of the water cycle)
Ask: Where does all that water come from, to feed the wells? (Answer: rain. Remember the water cycle? The hot sun evaporates water from the sea, leaving the salt behind. When all that evaporated water rises up high in the atmosphere, it cools and forms clouds. Clouds are made of tiny droplets of water. When the droplets get big enough, they fall down to earth as rain.) When drops of rain hit the ground, they start to flow downhill.



What is a watershed? (PowerPoint of watershed). (Answer: it's a valley that's high on the sides and low in the middle, so all the rain that falls in the watershed flows down the hillsides into the valley and then to the sea. Even the rainwater that soaks into the ground is pulled slowly downhill by gravity.)



(PowerPoint map of the Parker River watershed)
Hand out laminated maps of the Parker River watershed.

Georgetown is located in the Parker River watershed. The rain that falls in the Parker River watershed flows downhill to the Parker River. The Parker River flows through Georgetown on its way to the sea. Some of it gets pumped out of the ground by Georgetown's three town wells that are near the Parker River.

Ask: If the water for our faucets comes from the three town wells, and the water for the wells comes from rain, why does water keep coming out of our faucets, even when it does not rain for many days? (Answer: the three town wells keep pumping it out of the ground.)

So, the wells keep on pumping water, and water keeps coming out of our faucets, even when it has not rained for a long time. Think about that! Where does all that water come from after it stops raining? (Answer: There's a lot of water stored in the ground, kind of like a gigantic sponge!)

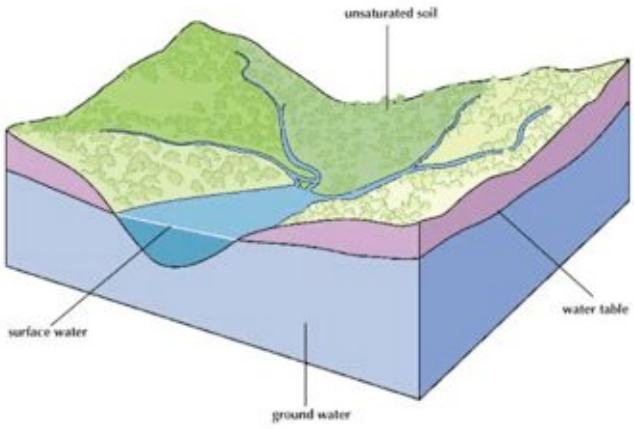
Show map of Georgetown Public Water Supply (PowerPoint map)
Point out the Parker River, and the locations of Georgetown's three wells.

All three wells are near the Parker River. Listen carefully, and I'll tell you why they were built there! (PowerPoint of watershed showing water table)

Over millions of years, sand and gravel erodes and washes down the hillsides and accumulates (or collects) in the lowest parts of the valley. Sand and gravel is permeable. That means there are spaces between the grains of sand and gravel that can fill with water. Water seeps slowly down the hillsides and collects in the sand and gravel in the valley. The sand and gravel in the valley is full of water, like a giant sponge.

Permeable sand and gravel that is full of water is called an aquifer. Aquifers are good places to build wells because there is plenty of water stored in the spaces between the sand and gravel. The best aquifers are usually down in the valleys near rivers and streams where all that permeable sand and gravel full of water can be found. Georgetown's three wells get their water from underground aquifers beside the Parker River.

The Parker River keeps flowing even after it stops raining. Why is that? (PowerPoint showing a watershed and the water table).

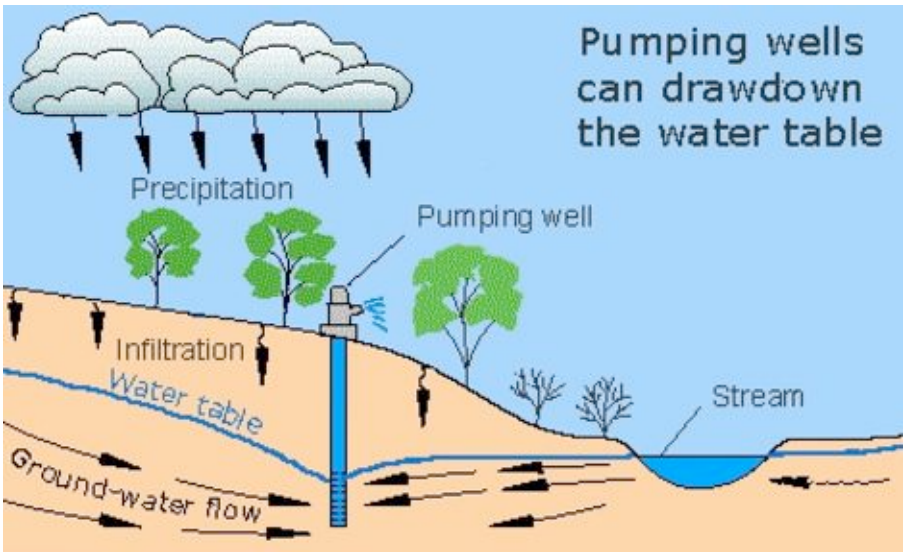


(Answer: the water in the ground is connected to the water in the river. When it rains, water soaks into the ground everywhere in the watershed. Underground water keeps seeping slowly downhill, until it seeps into the river and keeps the river flowing.)

The water table is the top of the water that is underground. Have you ever dug a hole in the sand at the beach? If you dig deep enough, you reach the water table, and water starts to fill the bottom of the hole.

The water table is at the same level as the surface of the river (point this out in the above PowerPoint illustration). If it does not rain for a long time, the water table drops, and so does the water level in the river.

Here's the problem: in order for the river to keep flowing even when it's not raining, the water table has to be high enough that water continues to seep into the river. If the water table drops down below the bottom of the river, the river will dry up.



As long as the water table is higher than the bottom of the river, the river keeps flowing. However, if it stops raining for a very long time (that's called a drought), the water table drops down, and the flow in the river slows down.

If you pump water out of the ground near a river during a drought, it takes away groundwater that the river needs to keep flowing. The water table drops down so far that the river dries up.

Parker River flowing

Parker River in summer of 2010

Georgetown is very close to using all of its available water every year. Last summer was hot and dry. People used so much water that the Parker River dried up.

This is a good time to find out what a groundwater aquifer is! And permeable sand and gravel, let's find out about that too!

Sponge and Pitcher Demonstration

Show the students a sponge and ask them to imagine that it is the land. Show them a pitcher of water and ask them to imagine it is a rain cloud. Holding the sponge at a slight angle over the bucket, pour a little water onto the sponge. Ask the students where the water went. (Answer: it's stored in the sponge, just like rain is stored in the ground.)

Then gradually pour more water onto the sponge until it starts to leak out from the lower corner into the bucket. Ask why the water is coming out. (Answer: the sponge is full, and cannot hold any more water, just like groundwater in an aquifer seeping out of the ground into a river.)

Groundwater Model Demonstration

Demonstrate the groundwater model. What happens when there is lots of rain? Show students how water from the inverted bottle fills the sand and gravel, just like rain falling on the land. Where does the water go? (It fills the tiny spaces between the sand and gravel particles and fills the river in the model. We call this layer of sand and gravel permeable. It can hold a tremendous amount of water, much more water than even the whole river. This sand and gravel full of water is called an aquifer.

The water table is the top level of the water. It is constant or even. Water is always pulled down by gravity, so it flows downhill and fills low areas like lakes and rivers. (Show the students how the water level in the flexible tube from the well is at the same level as the water in the model river.)

What happens to the water table when the well pumps out water? (Start the siphon and show the students how the water level begins to drop).

Discussion: Can we run out of water? What can make this happen? (Answer: lack of rain and too much pumping.) Show again the two PowerPoint photos of the Parker River with water and without water. (Add a drop or two of green dye to the river and start the siphon. Show the students how the green dye migrates through the sand toward the well. Then remove the Nalgene bottle from the model, explaining that doing so represents no more rain (like a drought). Keep the siphon running to show how the water level drops rapidly in the river as the water table falls, until the river is dry.

What happens when the river runs dry? (Answer: fish, turtles, salamanders, birds, beavers and other wildlife don't have enough water. Also, people are not allowed to water their lawns.)

Georgetown uses almost all of the water available, especially during a hot, dry summer.

To conserve water means to be careful and not wasteful about our water use. Will conserving water reduce well pumping? Will less well pumping help the river and all the fish and animals that need water in the river to survive?

Should we conserve water? (Answer: of course! We should do our best to conserve!)

Now we are going to show you an easy way to save water by using a low-flow aerator to make less water come out of the faucet.

Faucet Aerator Demonstration

With the old, high-flow faucet aerator in place, run water from the faucet into two one-gallon jugs for 60 seconds. Then measure how many gallons came out (should be between 1.5 and 2.0 gallons). That's the rate that water flows out of the faucet every minute. It's called gallons per minute. Write that amount on the blackboard.

Ask the students if they need a lot of flow to brush their teeth or wash their hands. (Answer: No. All you need is enough water for wetting and rinsing.)

Show the students what a 0.5 gpm low-flow faucet aerator looks like.

Then unscrew the old aerator and screw in a new 0.5 gpm low-flow aerator. Run the faucet into a one-gallon jug for 60 seconds. Measure the amount of water in the jug (should be approximately 0.5 gallons). Write that amount on the blackboard, and subtract it from the amount with the old, inefficient aerator. The difference (about 1 gpm) is how much water can be saved every minute with the new aerator.

Ask students how many minutes each day the bathroom sink runs (Answer: five minutes is typical. Write that on the chalk board).

Ask the students, how many gallons the low-flow faucet aerator will save every day? (Answer: 1 gpm times five minutes is about five gallons per day. Write that on the chalk board).

Ask how many days in a year (Answer: 365. Write that on the chalk board).

Then ask if anyone can multiply 5 gallons saved every day times 365 days in a year (Answer: almost 2,000 gallons. Write that on the chalk board).

Ask the students how much they think a low flow faucet aerator costs (Answer: less than $2.00). How much is 2,000 gallons worth? (Answer: more than $10.00). You only have to buy the aerator once. After that it keeps saving 2,000 gallons every year.

Project**:** Send a low-flow faucet aerator home with each child with directions on how to install it in a bathroom sink. (This is an optional parent/child project.) Worksheet will ask families to calculate how much water is saved. Please bring these sheets back to school. Remind students and teachers to make sure the aerator projects are completed by April 26 after spring break.

We will count the number of faucet aerators that the Penn Brook third graders install, and figure out how much water that will save. Some faucet aerators cannot be changed. In that case, maybe you can do it at your grandparents' house, or a neighbor's house, or a babysitter's house. Let's see how much water the Penn Brook third graders can save by installing as many low-flow faucet aerators as possible.

Glossary words:

watershed, groundwater, water table, permeable, erode, accumulate, aquifer, conservation, aerator, drought.

Sing Water Conservation Song

Assessment:

Ask: How does Georgetown get its water?
(Answer: from three wells near the Parker River that pump groundwater.)

Ask: Where is the best place to build a groundwater well?
(Answer: in an aquifer near a river.)

Ask: What might happen when a well near a river pumps too much water in a drought?
(Answer: the river might dry up.)

Ask: How much water can a low-flow faucet aerator save every year?
(Answer: about 2,000 gallons.)

Ask: If one faucet aerator can save 2,000 gallons per year, how much can 100 faucet aerators save?
(Answer: 200,000 gallons per year.)

Ask: How many Penn Brook third graders are there?
(Answer: 112.)

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Every Penn Brook third grader is invited to come and sing the Water Conservation Song together. A few students from each class will be invited to say something that they learned during this program. Next week each class will be assigned a topic to talk about. This is a very important part of this project because YOU get to tell the community what we learned about water conservation and how everyone in Georgetown can help conserve it. Start thinking about what you might say to convince other people in Georgetown to save water! It will be lots of fun and you will get to see yourself on Cable TV!

Ready for next lesson!

GWCP Paulette M. Morin

3/11

Penn Brook School Water Conservation Program

Lesson 3 – How can I measure and conserve water? – May 13, 2010

Students will know:

How to read a water meter
How much water costs
Water conservation methods

Students will be able to:

Convert water usage in cubic feet to gallons
Use a water meter to detect leaks
List several ways to conserve water

Materials:

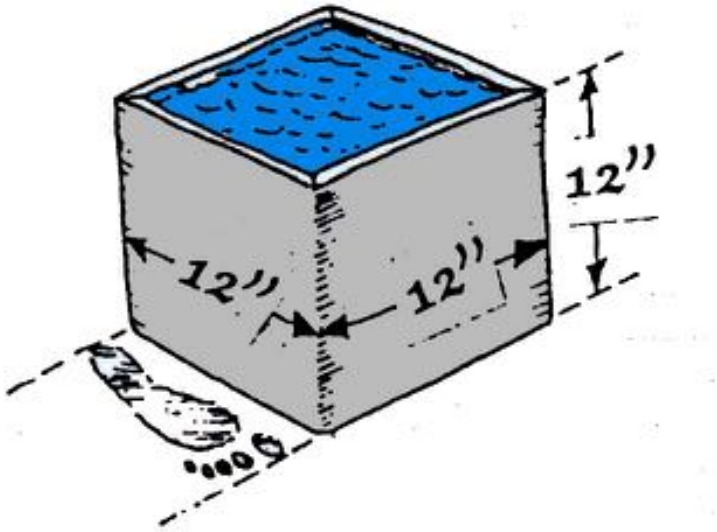
- PowerPoint Presentation including water conservation song
- 12 water meters
- Homework assignment: DROP 10% pledge forms, water conservation tips, AWWA water conservation booklets, and letters from Dr. Tanner
- AWWA water conservation stickers as rewards for doing prior assignment

<u>Demonstration – water meters</u>

Separate the class into groups (each with a teacher), each group with a **water meter**.

Every home and business in Georgetown has a water meter to measure how much water you use. When water flows through the meter, the number of **cubic feet** is measured and displayed on the face of the meter.

There are 7.5 gallons in every cubic foot.



Identify (with the assistance of the teachers) what each dial means on the water meter. Each time the red dial goes all the way around, the right-most number (the "ones" column) counts one cubic foot. After the dial goes around 10 times, the number in the tens column increases. After the tens column increases by 10 the 100's column increases. There are six columns on the meter, so it can read up to 999,999 cubic feet. Then the meter simply starts over again from zero.

Water Bills

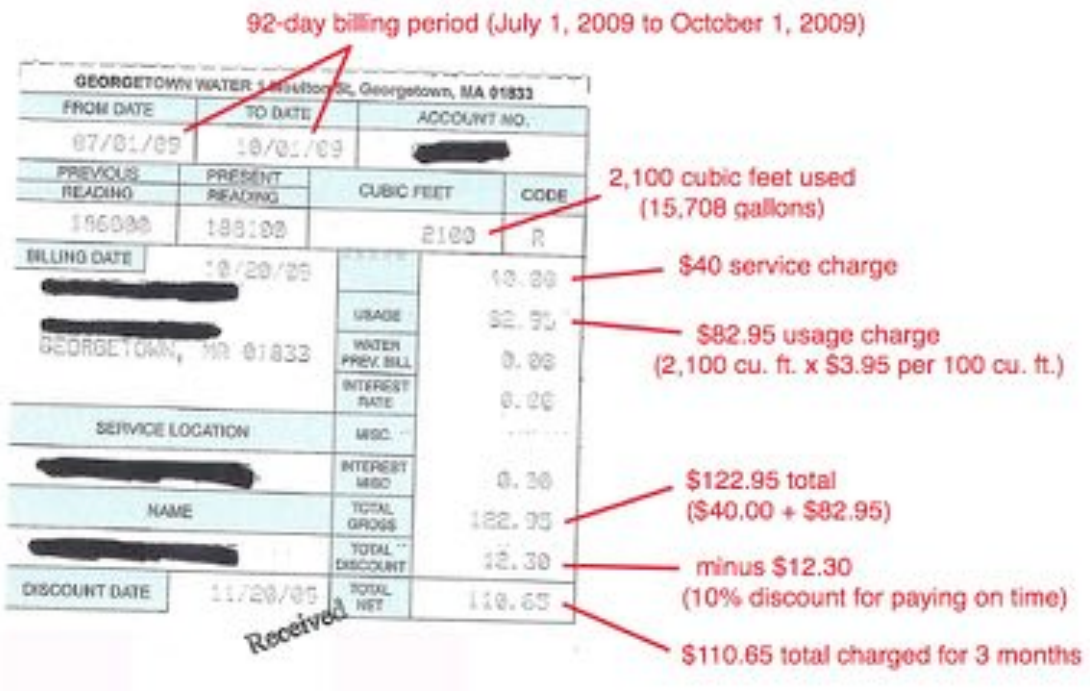
Every three months (about 90 days) a meter reader from the Georgetown Water Department reads each meter in town. They subtract the previous meter reading from the latest meter reading to figure out how much water you used during the past three months. Then they send you a **water bill** and you have to pay for the water you used. The more water you used, the more money you have to pay to the Water Department.

Project a slide of a water bill. Explain the "ascending block" water rates and how the Water Department calculates the charges.

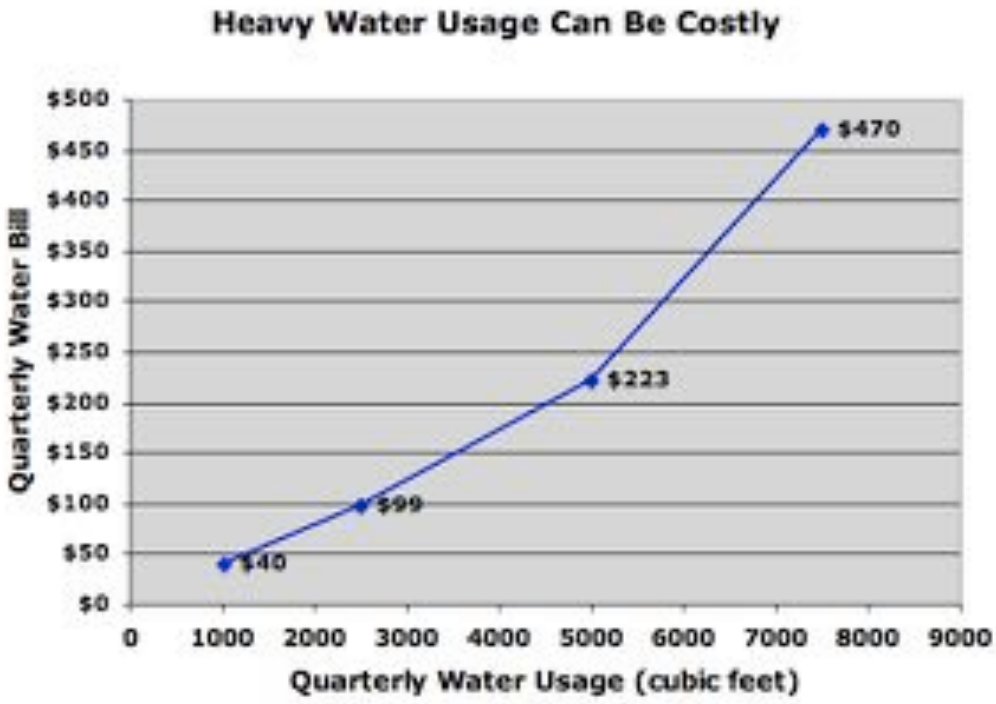
Georgetown Water Rates

Service charge of $40 every three months, plus:

0 - 2,500 cubic feet: **$3.95** per 100 cubic feet.
2,500 - 5,000 cubic feet: **$4.95** per 100 cubic feet.
5,000 - 7,500 cubic feet: **$5.95** per 100 cubic feet.



Then project a slide showing how the cost of water increases as you use more water.



Leaks

If there is a leak in your home, you are paying for water that you are not using.

Point out the little red triangle on the water meter. Show how the little red triangle turns by blowing air through the meter. When the red triangle is turning, water is flowing somewhere in the house. If the red triangle is turning while nobody is using water, it usually means there is a leak.

Question: how much water can you lose if you have a leak?
Answer: a lot.

	Hole	Gals/min*	Gals/yr*
Size of a pin hole →	.027"	0.12	60,000
	.035"	0.19	100,000
	.056"	0.48	250,000
	.080"	0.96	500,000
Size of a nail hole →	.113"	1.92	1,000,000

**assuming 40 psi of water pressure*

Here's what a one-million gallon water tank looks like:

Question: what are the most common things that leak?
Answer: toilets, faucets and lawn irrigation systems.

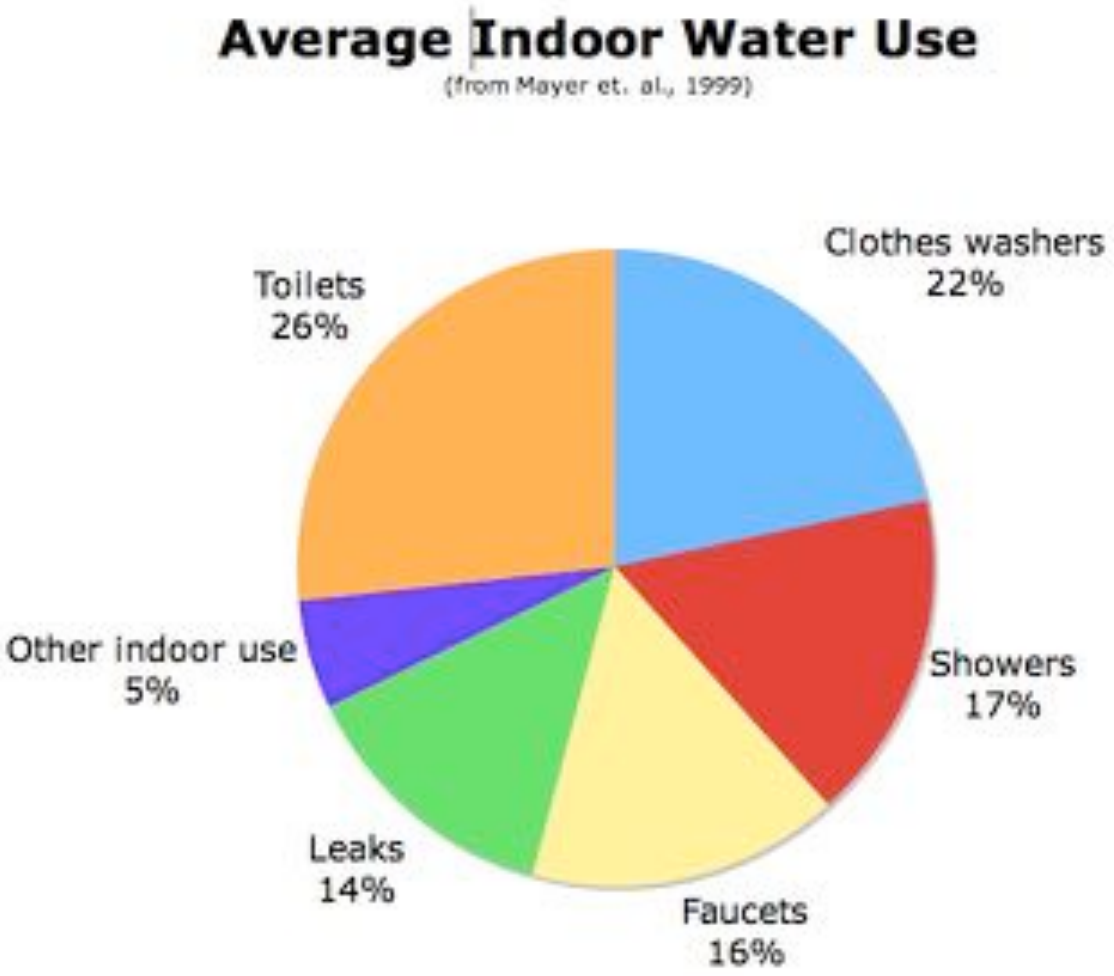
Question: what should you do if you have a leak?
Answer: call a plumber and get it fixed right away.

Daily water usage

There are four main water uses indoors:

- Toilets
- Clothes washers
- Showers
- Faucets

Saving water from each of these main uses adds up to a lot of water!



1. Toilets

Toilets installed before 1990 use at least 3.5 gallons of water per flush. There are new toilets called High Efficiency Toilets that use less than 1.3 gallons per flush. A High Efficiency Toilet can save 5,000 gallons of water every year, which equals 100,000 gallons in 20 years!

If you go to a store to buy a toilet, you can tell if it is a High Efficiency Toilet if it has a WaterSense label.

EPA WaterSense

2. Washing machines

Front-load washing machines save about 5,000 gallons per year compared to top-load washing machines, and they save energy too!

Front load:

Top load:

You can save water by doing one full load of laundry instead to two half-loads.

3. Showerheads

A 1.5 gallon per minute (gpm) showerhead uses 40% less water than a standard 2.5 gpm showerhead, saving about 2,000 gallons per year. Saving heated water saves energy too!

Try to limit your shower time to 5 minutes or less.

4. Faucet aerators

Bathroom faucet aerators that use 0.5 gpm can save over 2,000 gallons of water per year.

Bathroom (0.5 gpm)

Kitchen (1.5 gpm)

How much water can my family conserve?

Worksheet. Discuss each item. (with teacher support)
Calculate how much water is used by your family, in a day, a week and a year.

If a family of four replaced two old 3.5 gallon per flush toilets, one old top-load washing machine, installed two low-flow showerheads and two bathroom faucet aerators, how much could they save per year?

Two toilets:	10,000 gallons
Washing machine:	5,000 gallons
Two showerheads:	4,000 gallons
Two faucet aerators:	4,000 gallons
Total savings:	23,000 gallons per year

At $5.00 per thousand gallons, that would save $115 per year in water, plus additional energy savings.

You can save water outdoors by not watering the lawn when it's not necessary, using a broom to sweep the driveway instead of a hose, and using less water to wash the car.

How can I personally conserve?

Use same worksheet. Discuss each item. (with teacher support)

The average person in Georgetown used 67 gallons per person per day in 2008. About 8,700 people live in Georgetown. If each one dropped 10%, the whole town could save over 20 million gallons of water per year, saving money and helping the environment.

Work on Selectmen presentation and/or water conservation posters for 15 minutes

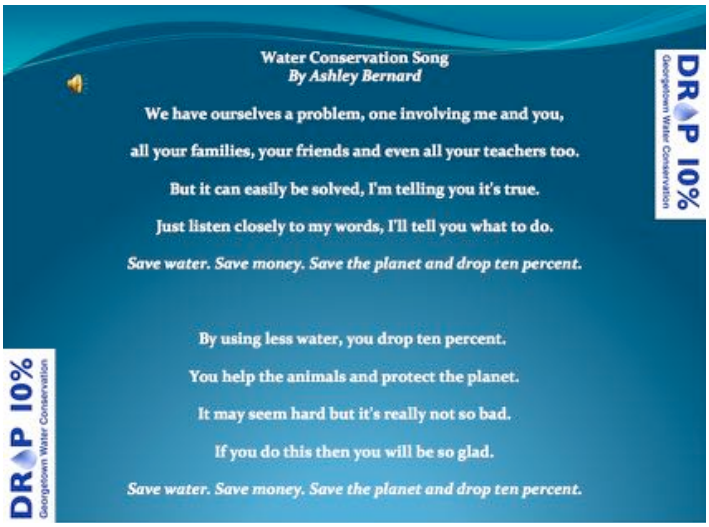
Discuss how students can make a difference in Georgetown.

- Set a good example by reducing water use 10% at home.
- Write essays to present at a televised Selectmen's meeting.
- Make posters to display at the library, town offices and the public schools.

Homework: Family Pledge

Distribute Family Pledge forms, pledge worksheets and water meter worksheets. Go over Family Pledge. Ask students to ask their families to pledge to DROP 10%.

Sing water conservation song



Penn Brook School Water Conservation Program

Lesson 4 – Saving Water, Water Shortages in Other Countries – May 19, 2010

Students will know:

How much water usage varies from family to family
How much water can be saved by replacing aerators.
How much water can be saved by reducing water use by 10%.
How water shortages affect people in other countries.

Students will be able to:

List several ways to conserve water, and how much each one saves.
Write a short essay on water conservation

Materials:

Results of water bill survey (homework from Lesson 1) in gallons per person per day
Results of aerator installation exercise (homework from Lesson 2)
Results of DROP 10% pledges (homework from Lesson 3)
PowerPoint slides showing calculations of water savings
Recording of the Water Conservation Song

<u>Review results of three homework exercises</u>

<u>A. Average water usage</u>

Calculate how much water is used by an average person in Georgetown in a year, based on 2008 town-wide average of 67 gallons per person per day. (Answer: 24,465 gallons per year).

Calculate how much water is used by an average student in the Penn Brook School in a year, based on the average of 36 gallons per person per day in the survey.
(Answer: 13,140 gallons per year).

Why is the Penn Brook survey so much lower than the town average?
Point out that the Penn Brook survey reflected winter usage only, which is typically only 2/3 as much as summer usage.

Average water usage in China per person is about 1/3 that of the United States.

Penn Brook School
Household Water Usage Survey

Gallons per person per day
13
17
17
17
19
20
20
22
23
25
27
27
27
29
31
33
35
35
38
41
44
45
46
48
48
52
52
53
56
63
64
72
74

Total (33)	1,233
Average	37
Minimum	13
Maximum	74

DROP 10%
Georgetown Water Conservation

<u>B. Savings from faucet aerators</u>

In the second class on May 7 we found out that changing a faucet aerator saves over 2,000 gallons per year. Multiply 2,000 gallons per year per aerator times the 50 aerators changed. Aerators installed by students at the Penn Brook School are saving a total of about 100,000 gallons per year!

If water costs $5.00 per thousand gallons, how much is 100,000 gallons worth?
Answer: $5.00 x 100 = $500

If a faucet aerator costs $2.00, how much do 50 aerators cost?
Answer: $2.00 x 50 = $100

How much money will we save in the first year?
Answer: $500 - $100 = $400
Will the aerators keep saving water year after year?
How much money will the aerators save in the second year?
Answer: $500 (we already paid for the aerators in the first year!)

Penn Brook School
Aerator Replacement Survey

Old Aerator Gallons/Year*	New Aerator Gallons/Year*	Gallons Saved Per Year*	Dollars Saved Per Year**	Payback Period*** (in months)
1,597	913	684	$3.42	18
1,825	913	913	$4.57	13
2,828	913	1,715	$8.58	7
2,738	913	1,825	$9.13	7
3,194	913	2,281	$11.41	5
3,422	982	2,440	$12.20	5
3,878	913	2,966	$14.83	4
4,106	912	3,194	$15.97	4
4,220	912	3,308	$16.54	4
	Average	2,147	$10.74	7

*Assuming faucet is used five minutes daily
**Assuming a water rate of $5.00 per thousand gallons
***Assuming the cost of a faucet aerator is $5.00

DROP 10%
Georgetown Water Conservation

Assuming the following savings for toilets, washing machines, showerheads and faucet aerators, how much water could an average family save per year INDOORS?

Replace an old 3.5 gallon toilet with a High-Efficiency Toilet:
5,000 gallons per year
Replace a top-load washing machine with a front-load washing machine:
5,000 gallons per year.
Replace a 2.5 gallon per minute showerhead with a 1.5 gpm showerhead
2,000 gallons per year
Replace a 2 gpm bathroom faucet aerator with a 0.5 gpm faucet aerator
2,000 gallons per year

Total savings: 14,000 gallons per year.

Questions:
How much money does conserving 14,000 gallons per year save?
Answer: $5 per 1,000 gallons x 14,000 gallons = $70 every year
Will you energy bill be lower too? Why?
Answer: Some of the water you save in the shower and the laundry is heated.
How many toilets are in a typical house? How many showers? How many faucets?
How could you save water OUTDOORS? Did you ever see an irrigation system watering a lawn while it is raining out? Is it possible to have a nice lawn without any irrigation in our rainy climate?

C. Savings from DROP 10% pledges

Count the number of families who took the DROP 10% pledge. Multiply by an average savings of 7,000 gallons per family (based on typical family usage of 70,000 gallons per year) to get total amount saved.

Questions:
If water costs $5.00 per thousand gallons, how much money will be saved every year if everyone keeps their pledges?
Is it possible to save more than 10%? How could that be achieved?
Why do some families use less than 20 gallons per person per day, and other families use more than 50 gallons per person per day?

Penn Brook School - Drop 10% Pledge Results

Number of Families Who Pledged to DROP 10%	Water Usage of a Typical Family in Gallons/Year	Gallons Saved Per Family Per Year	Gallons Saved By All 53 Families Per Year	Number of Families in Georgetown	Gallons saved Per year If Every Family Dropped 10%
53	70,000	7,000	**371,000**	2,700	**18,900,000**

DROP 10%
Georgetown Water Conservation

Water shortages in other countries

In America we are lucky to have clean, safe water piped directly to our homes. In other countries, people are not so fortunate.

Mother of five Ayisa Bombu lives in Ghana. Ayisa has to fetch water from a large pond. The water is dirty, and has to be boiled before drinking it to kill the germs.

These Chinese villagers are getting their water from a rusty old water truck. Do you think you would like to drink water from that truck? How would you like to have to carry water home instead of getting it from the faucet?

These Kenyans get their water from a tank. When the water in the tank gets so low that it will not come out of the faucet on the side of the tank, they have to bail it out of the bottom of the tank with buckets.

Then they walk several miles through the desert to take the water to their homes.

These Ethiopian children must carry their water up a steep trail to their homes.

During the dry season in India they dig down into the earth and collect the water that seeps into the hole.

Essays and Posters

A. Prepare presentation for Selectmen's meeting

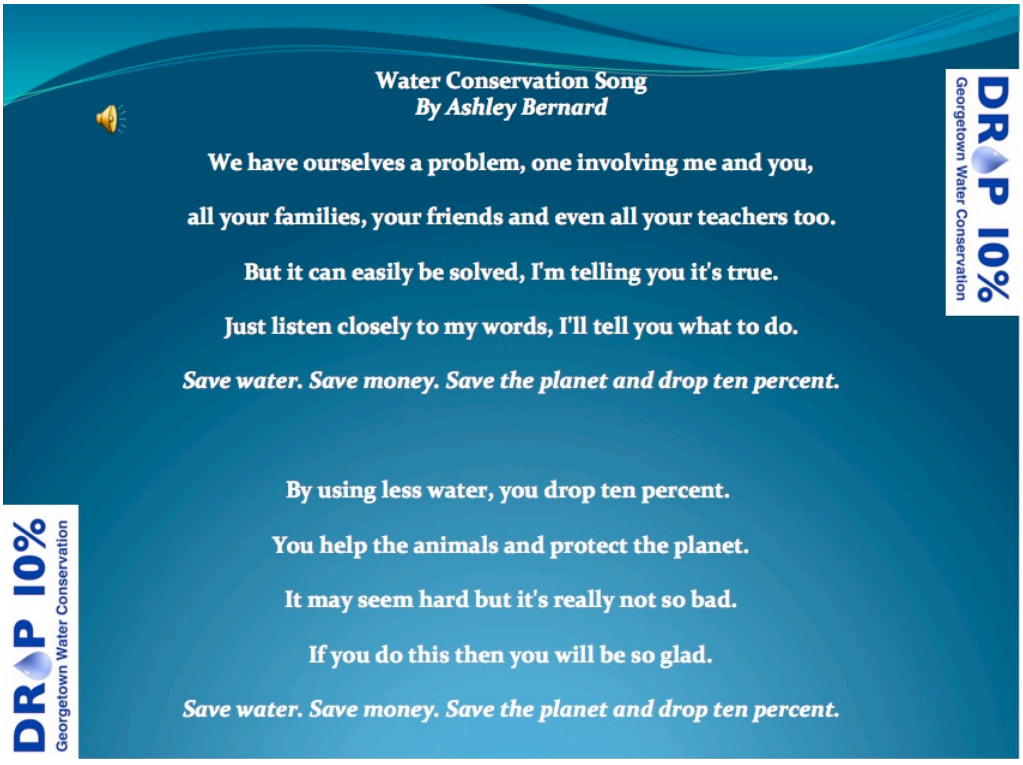
Divide the class into six groups. Assign students in each group to write a short essay about one of the following six topics:

1. Why conserve water?
2. Water Use Survey results: what do they mean for Georgetown?
3. Saving water with faucet aerators
4. DROP 10% Pledge: how much water can the Penn Brook School save?
5. How can we conserve water? How much can we save from each thing?
6. Water problems in other countries: why are we lucky to live in Georgetown?

- Collect the essays. Judge them within a few days and select up to ten of the best ones.
- Notify the winning students and obtain parental permission for them to participate.
- Contact the Selectmen's office to schedule the presentation.
- Arrange a rehearsal for the students to practice reading their essays and also sing the water conservation song.
- Prepare PowerPoint to show the results of the water bill survey, the faucet aerator exercise, and the DROP 10% pledges, and make copies of these exhibits to hand to the Selectmen.
- Get faucet aerators to give to each Selectman.

B. Have students show their water conservation posters to the class, and discuss where they might best be displayed to convince people to save water in Georgetown.

Sing water conservation song



Water Conservation Song

By Ashley Bernard

We have ourselves a problem, one involving me and you,

all your families, your friends and even all your teachers too.

But it can easily be solved, I'm telling you it's true.

Just listen closely to my words, I'll tell you what to do.

Save water. Save money. Save the planet and drop ten percent.

By using less water, you drop ten percent.

You help the animals and protect the planet.

It may seem hard but it's really not so bad.

If you do this then you will be so glad.

Save water. Save money. Save the planet and drop ten percent.

Save water. Save money. Save the planet and drop ten percent.

DROP 10%

Georgetown Water Conservation