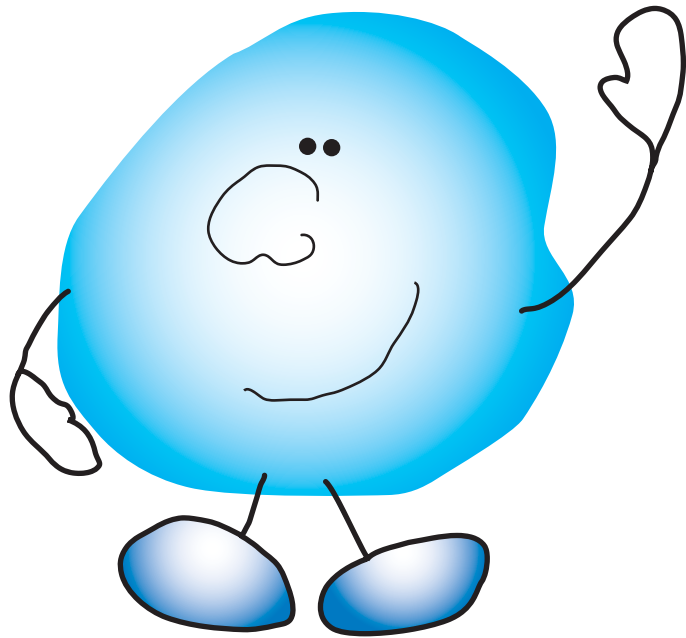


My last stop is at the Chlorine Basin, where bleach will kill any harmful bacteria that may still be present. Then I am treated to a nice rinse to remove the bleach so it doesn't harm the plants, fish or other wildlife in the river. After that I'm off to the river - maybe I'll get to visit the ocean!

What an amazing ride it's been. It's nice to be clean again. Thanks for coming with me.



Come & visit Gresham's Wastewater Treatment Plant again. I'm going to try to come back to visit & maybe I'll see you again.



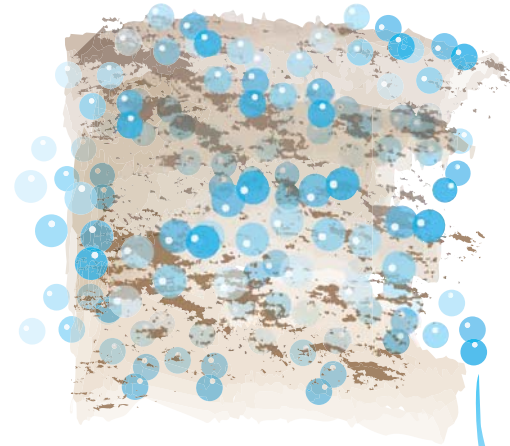
Hello Scientists!

Welcome to the City of Gresham's Wastewater Treatment Plant – home to more than 20 million gallons of water a day. I am so excited that you are here to help me conquer my fear of traveling.

Today is an exceptionally important day for me as a water molecule. I am going to embark on my first journey through the Wastewater Treatment Plant - or WWTP. Can you keep a secret? Truthfully, I am really nervous. I have traveled to many places as a water molecule, but I have never taken this journey before. My friends from school said that it is a fascinating voyage so I am glad that you can come along for the ride.

Stop & Think:

Can you think of some places that a water molecule might travel to?



Before water is removed by the belt presses, the biosolids are heavy & have more volume.

I just got squeezed out!



Removing water decreases the volume & weight of the biosolids.

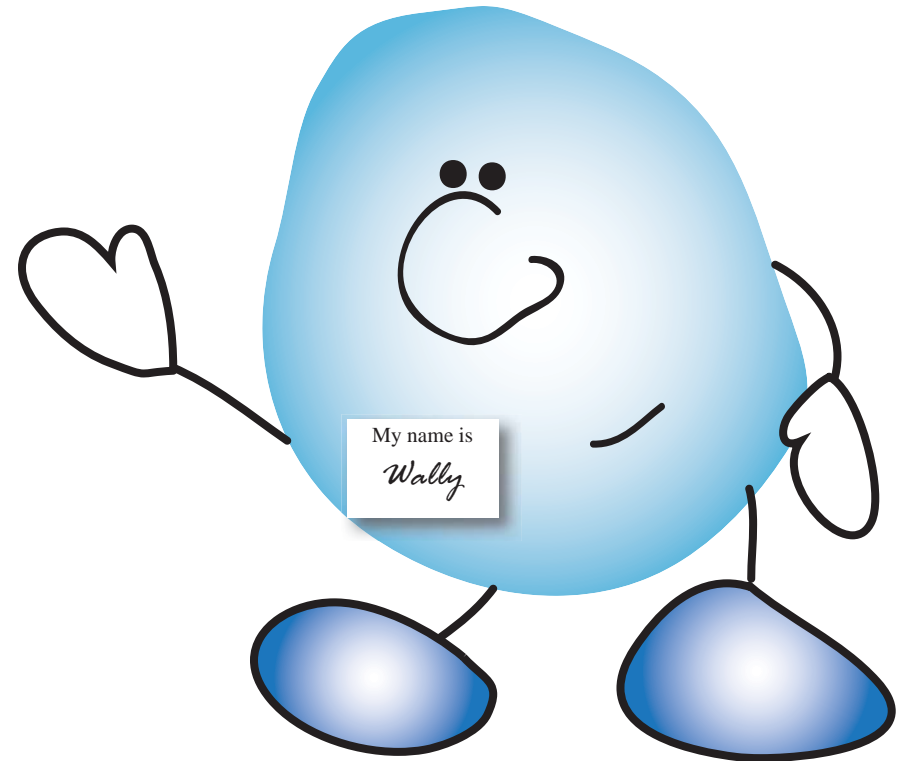


Belt Filter Presses/ Cake Biosolids

Now that we know more about where the *liquid* goes after the Primary Clarifier, let's find out what happens to the *solid* waste materials. We will need to learn about the Belt Filter Presses.

After the bugs eat the bacteria in the Anaerobic Digester, the digested solids are mostly water – which must be removed. The solids are taken to the Belt Filter Presses, which remove most, but not all of the water. What remains is called Cake Biosolids and it is used as fertilizers on farms.

Your visit is greatly appreciated.



Stop & Think:

Why do you think it is important to send the solid waste through the Belt Filter Press before transporting it to farms?

Before we begin our journey,

I should probably tell you a little about myself. My name is Wally and I am a typical water molecule. I am made up of two hydrogen molecules and one oxygen molecule. People sometimes call me H₂O for short.

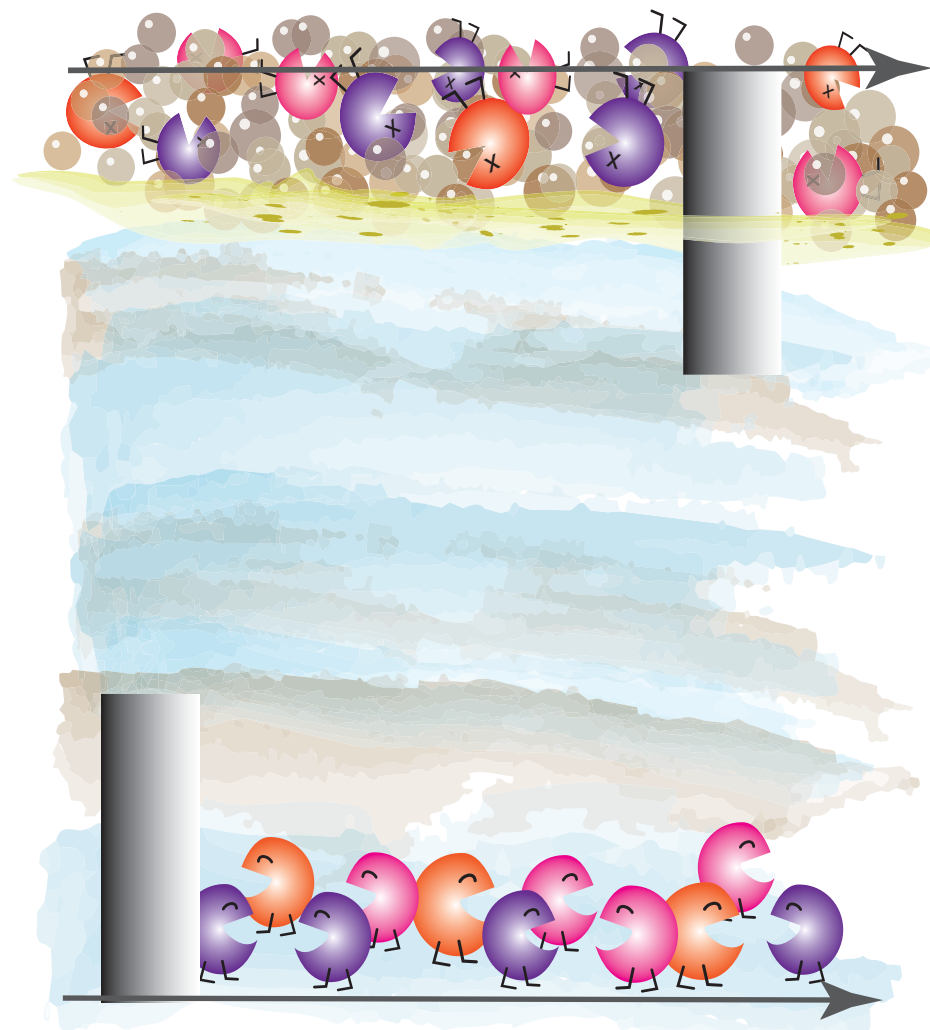
I have been part of the water cycle for ages. I'm sure you have heard of me before, since I am such a valuable resource. Without me, all living things would die.

You might think that new water forms in clouds and falls to the ground, but actually there is only a fixed amount of water on the earth. As water molecules, we just keep going around and around through the water cycle – this is what we've been doing since the earth was formed.

Stop & Think:

What are some ways we use water every day?

Scum & dead bugs are skimmed off, then sent to the Anaerobic Digester.

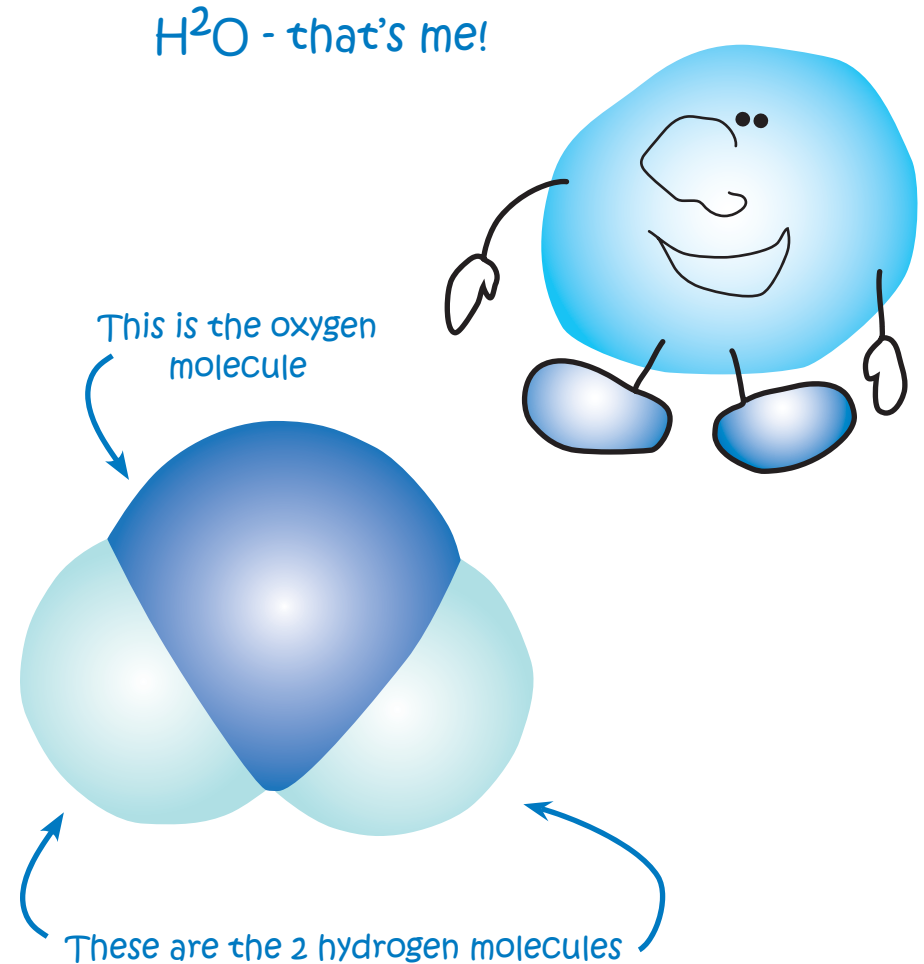


Fat & happy, these bugs are sent back to the Aeration Basin to grab more food.

Secondary Clarifier

After leaving the Aeration Basin, the water is sent to the Secondary Clarifier. While in the Secondary Clarifier, the microorganisms sink to the bottom to consume their food. Any microorganisms that have died will float to the top of the tank and will be scraped off and sent back to the Anaerobic Digester. The microorganisms' job of eating bacteria is done – they did good work to help clean water.

The water from this tank is then sent through the disinfection process called the Chlorine Contact Basin. During this step, any microorganism that has made it this far will die after coming in contact with the chlorine. The water is now ready to send out to the Columbia River.



Stop & Think:

Why do you think staff at the Wastewater Treatment Plant measure and test the water before it flows to the river?

Did you know that of all the earth's water, 99% is either salt water, frozen, or too polluted for human consumption?

Only 1% of the earth's water is available for drinking.

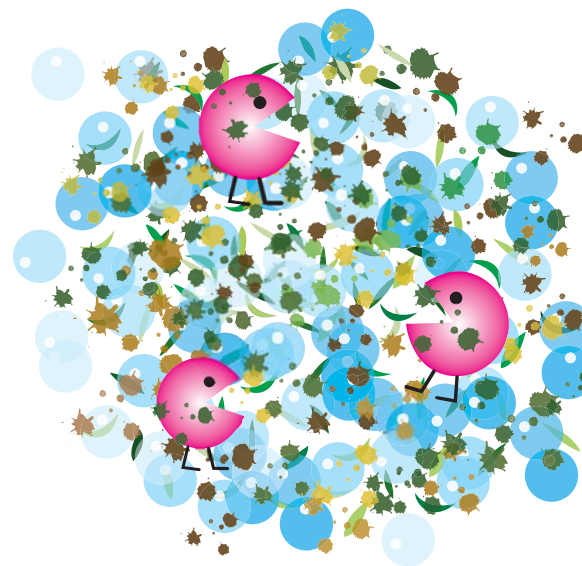
The great thing about the water cycle is that it does not have a beginning or an end. The way the water cycle works is simple. Water is constantly moving between the air and the ground through the process of the water cycle. We mainly see water when it is on the ground in ponds, rivers, lakes and oceans, or coming out of the faucet in our house.

Did you know that the ocean holds most of the water on earth? It's true. In fact, the ocean covers about 70 percent of the earth's surface. So how does this amazing process work? How does water travel from a pond to a cloud and back to the ocean?

There are three main parts that you should know about. First, we can look at **evaporation**. The evaporation process begins with the sun, the source of energy, shining on the water and warming it up. As the sun warms the water, the liquid changes to a vapor, or gas, which is lighter than the air around it. The water vapor rises into the sky, or we can say that it evaporates.

Next, I should tell you scientists that the higher the air gets above the earth, the colder it becomes. As the warm water vapor rises and cools, it changes form again. **Condensation** is when water changes into a liquid form that is visible as a cloud.

This is where my water friends and I rejoin the process.



These bugs ooze a glue so when the bubbles bring food in contact with them, it sticks to their skin.

Aeration Basin

Now that you've seen where the solids go, it's time to see where the liquids go – that's me!

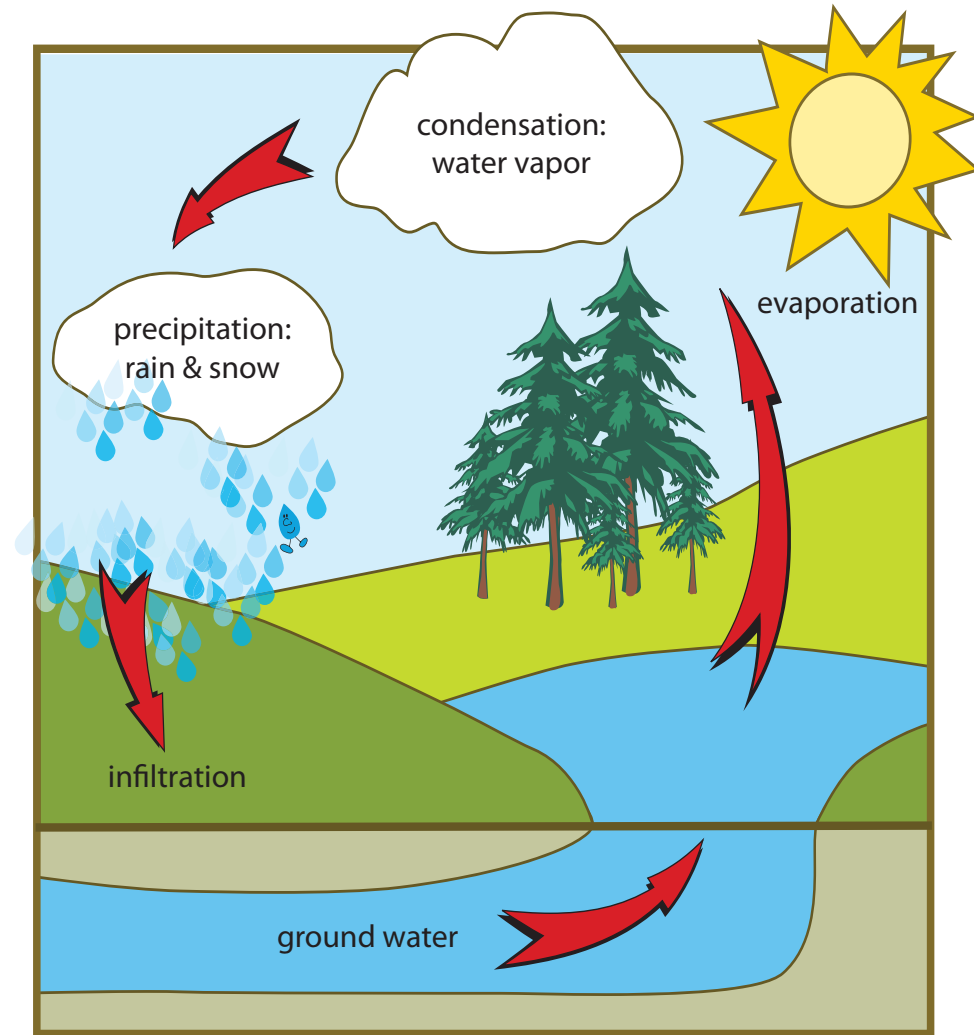
Basically, the Aeration Basin is an enormous pool party hosted by a different group of bugs. Here in this giant pool, an amazing part of the water treatment process is taking place. This is a biological treatment method where microorganisms such as bacteria and protozoa consume the remaining organic material in the water.

The bubbling action is air being pumped into the water to bring the food in contact with the bugs. It also keeps them super charged so they grab more food.

Stop & Think:

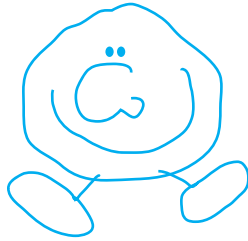
What do you think all of the brown foam floating on top of the water could be?

This is the water cycle



*That's me & my friends last week as rain.
We've been cycling since day one!*

Lastly, the movement of the water from the air to the ground in liquid or solid form is called **precipitation**. Precipitation can take the form of rain, sleet, snow, or hail. Personally, I love it when I get to be part of a hailstorm. It is a remarkable experience as a water molecule!



This is what I look like as hail.

When precipitation falls to the earth, several things can happen. We water molecules can be absorbed into the soil, which we call **infiltration**. This process allows water to seep into the earth where it is stored underground as groundwater. Precipitation can also become runoff, flowing into rivers and streams. We can also evaporate, or we can be returned to the atmosphere by **transpiration** - that's when water evaporates from the leaves, stems and flowers of plants. The water cycle never stops.

Stop & Think:

Re-read through Wally's explanation of the water cycle. Can you explain the water cycle using juicy vocabulary words to a friend?

These bugs don't need air to live. They have a nice warm environment with plenty of yummy solids to eat!



Methane gas, a byproduct of this process, is captured nearby & used to generate power for the WWTP.

Anaerobic Digester

I bet you won't second guess me now! Isn't it amazing that bugs can actually eat the odor out of the air? Incredible!

This gigantic building is called the Anaerobic Digester. This is where solids that were collected in the primary clarifier are treated. In this tank there are microorganisms, or bugs, that do not require air. You are right! Anaerobic means having or providing no oxygen.

The microorganisms' job is to consume the solids as food. Over a period of about 30 days, the microorganisms eat the organic material as a food source and the byproducts of this process are methane and water.

Stop & Think:

What do you think the word "byproduct" means? Re-read Wally's explanation of the Anaerobic Digester and see if you can figure out what a byproduct might be. Can you think of any other byproducts?

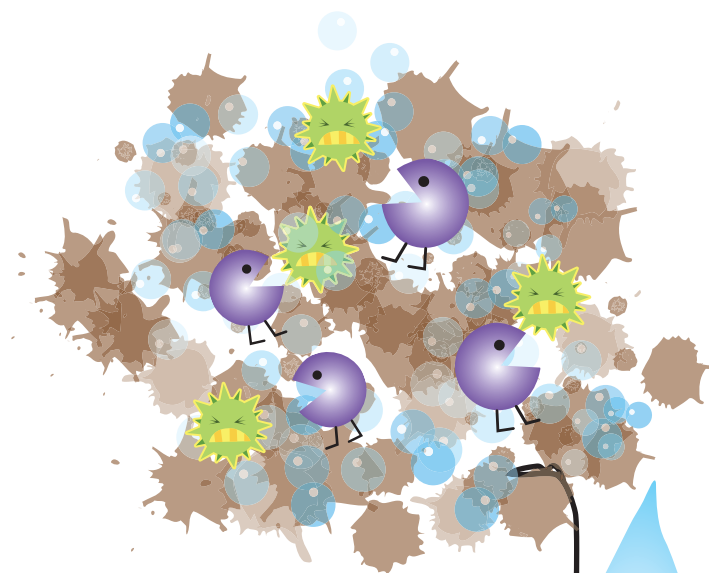
Transpiration is just one way I move around the water cycle



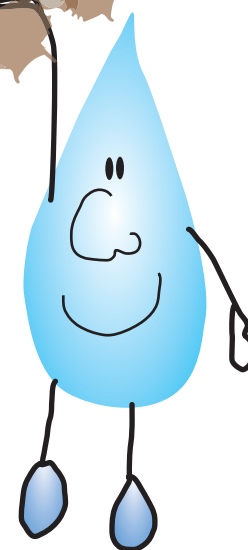
Transpiration is the plant version of sweating. Stems, flowers and leaves have openings, called stomata, that are similar to our pores. Water leaves plants through the stomata, just like water leaves our bodies when we sweat.

Phew, that was a lot of information. You might be wondering what the water cycle has to do with our visit today at the WWTP. As I mentioned before, today I will journey through the WWTP as part of my water cycle.

Just yesterday, I was used to wash some deliciously ripe strawberries in a household sink. Of course, I was then sent down the drain and into pipes that took me here. Now that you have arrived, I am ready to go!



Stop & ask your tour guide how these bugs eat odors!

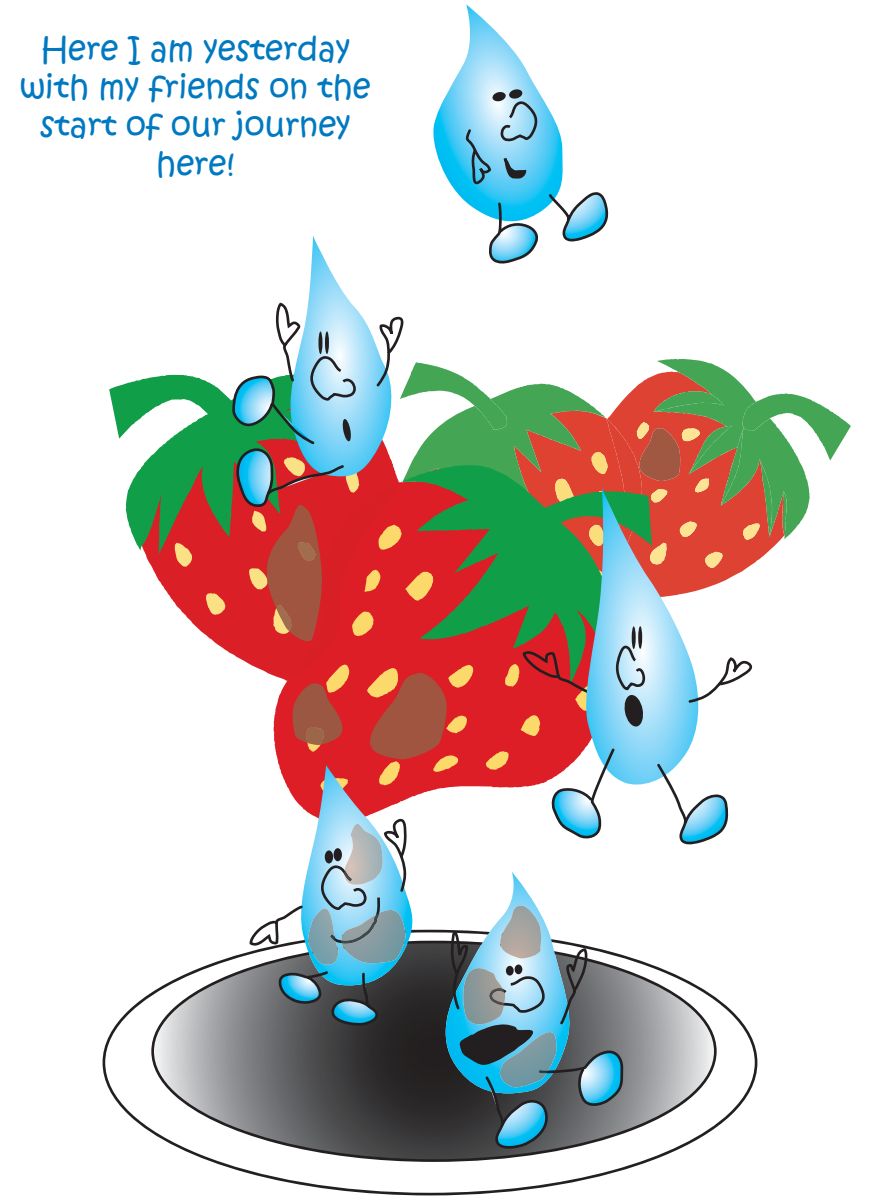


The first stop on our journey is going to be the Headworks. So keep those hardhats on tight, & get ready for the ride of your life!

Biofilter Odor Control

Before I take you to the Anaerobic Digester, let's stop and check out this mound of bark dust to the left.

I am going to tell you something that might blow your mind. Are you ready? In that pile of bark dust are millions of bugs that are eating the odor in the air. I know what you are thinking, that bugs can't eat air, and especially not odor that is in the air. I'm telling you, they can!



Headworks

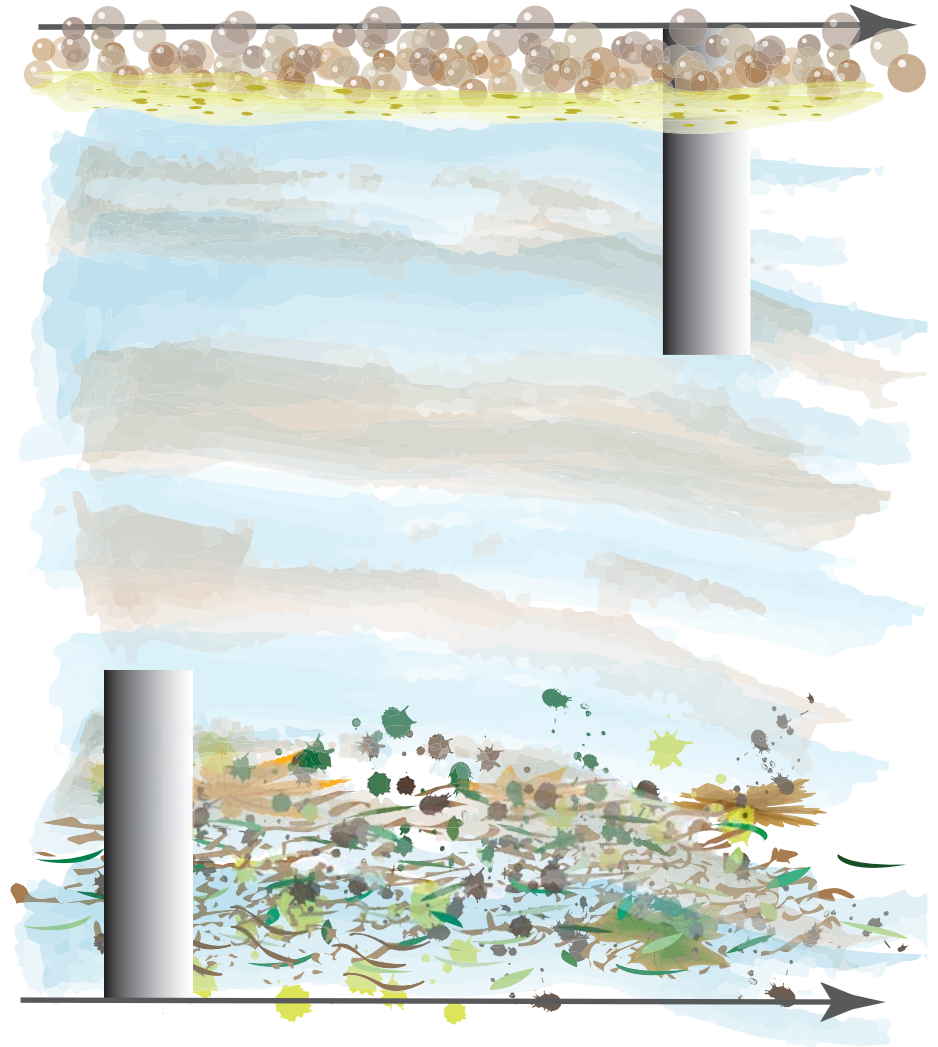
Have you ever stopped to think about where drinking water comes from and where water disappears to after it goes down the drain? Basically, clean drinking water comes into our homes, schools, and buildings through one set of pipes and leaves as wastewater through another set of pipes. The dirty wastewater that is flushed down the drain from our homes and businesses must be treated so that it can be safely recycled back to nature. That is what happens here at the WWTP.

The Headworks is an important part of the treatment process. Here the bar screens rake off and remove large debris from the water. The debris removed at the headworks is inorganic which means it is non-living material.

Stop & Think:

Why do you think the treatment plant wants to remove the larger debris from the water before it moves on to other stages of treatment?

Lighter materials - like oils, fats & grease - float to the top & are skimmed off.



The heavier organic solids sink to the bottom of the tank.

Primary Clarifier

Next, our journey takes us to the Primary Clarifier where the water is stirred and air is added. In the Primary Clarifier, water is slowed down and held in a large tank for several hours.

From here, the liquid and solids take two different routes around the Plant. Since I am a liquid water molecule, I'll go by gravity to the Aeration Basin. However, the solid materials take a trip to the Anaerobic Digesters.

Stuff like rocks, eggshells, sticks, trash, rags, & plastic are removed from the water at this stage.



The bar screen physically removes anything that is more than $\frac{1}{2}$ " wide.



This is how big $\frac{1}{2}$ " is.

Stop & Think:

*What do you think anaerobic might mean?
I'll give you a clue. Aerobic means having or
providing oxygen.*

Grit Chambers

Here we are at the Grit Chambers, which are located underground. These are large chambers that work to slow down incoming wastewater just enough so that sand and grit fall to the bottom. They use gravity to remove heavy materials.

Grit chambers can be complicated to operate. If the water is too slow, then too much grit will drop out and there will be more organic material that drops out, too – before it is treated. Yet, if the water is moving too quickly, then not enough of the materials fall out. The speed of the water and the amount of grit has to be in perfect balance.

When the water goes through this process it helps protect the pumps and equipment used at the WWTP. It also helps keep the sand out of the primary clarifier where we are headed next.

Stop & Think:

If inorganic material is not living, what do you think organic material is?

