Pre/Post Visit Activities

Wastewater: We Treat it Right!

Lesson

Recommended for 4th- 8th grade

Lesson Description: Students will work with their peers to clean up a sample of simulated wastewater. Together they will test and analyze several cleaning methods in an attempt to make it "clean." Along the way they'll learn about the wastewater treatment process and how it differs from drinking water treatment, and meet the microorganisms responsible for eating waste.

Objective: Students will exercise teamwork and make educated guesses to find solutions to wastewater clean-up. They'll understand that wastewater treatment mimics processes in nature.

Idaho State Science Standards Met for Grades 4–8
4: 4.S.1.1.1, 4.S.1.2.1, 4.S.1.2.3, 4.S.1.3.1, 4.S.1.6.2, 4.S.1.6.3, 4.S.1.6.5, 4.S.1.8.1
5: 5.S.1.1.1, 5.S.1.2.1, 5.S.1.2.3, 5.S.1.3.1, 5.S.5.1.1, 5.S.5.2.1, 5.S.5.2.2, 5.S.5.1.1, 5.S.5.2.1
6: 6.S.1.1.1, 6.S.1.2.1, 6.S.1.2.3, 6.S.5.1.1, 6.S.5.2.1
7: 7.S.1.2.1, 7.S.1.2.3, 7.S.5.2.1
8: 8-9.ES.1.2.2, 8-9.ES.5.1.1, 8-9.ES.5.2.1

Contents:

For more information, please contact:
Boise WaterShed Environmental Education Center ▪ (208) 489-1284 ▪ www.BoiseEnvironmentalEducation.org

Background Information

Image courtesy of www.gasdetection.com

Also known as raw sewage, **wastewater** includes the water you flush down your toilet and the water that drains from your bathtub, sink, washing machine and other domestic sources: these comprise **domestic wastewater**. Businesses, agriculture, and industries also produce large quantities of wastewater; this is **industrial wastewater**. The average American contributes 265-568 liters (66 to 192 gallons) of wastewater each day. Wastewater is about 99% water by weight and is generally called **influent** as it enters the wastewater treatment facility. In the wastewater are dissolved and suspended **contaminants**, which are substances that can produce negative effects in a natural system if they are present in high enough quantities. Contaminants which occur in wastewater can include animal and human wastes, oils, pesticides, detergents, fertilizers, or silt, for example.

What is Wastewater Treatment?

Aerial view of West Boise Wastewater Treatment Plant, courtesy of City of Boise.

At a **wastewater treatment plant**, wastewater is cleaned before it is returned to lakes, rivers, or streams. There are no holidays for wastewater treatment; most plants operate 24 hours per day every day of the week. Most treatment plants use **primary treatment** (physical removal by floating oils and sinking solids) and **secondary treatment** (the biological removal of dissolved solids). The processes of wastewater treatment are similar to natural processes by which water is cleaned. For example, when river water flows into a lake, solid contaminants can sink to the lake bottom in a physical process called **settling**. Water undergoes natural **filtration** as it moves underground through soil or rock. Evaporation allows water to separate from contaminants; this cleaning process is called **distillation**. And, the slimy coating on rocks in streams is made of living **microorganisms** (living creatures which are too small to be seen with the naked eye) which consume some contaminants, thus removing them from the water. In wastewater treatment, we use the same processes to clean water that occur in nature- we just do it faster!

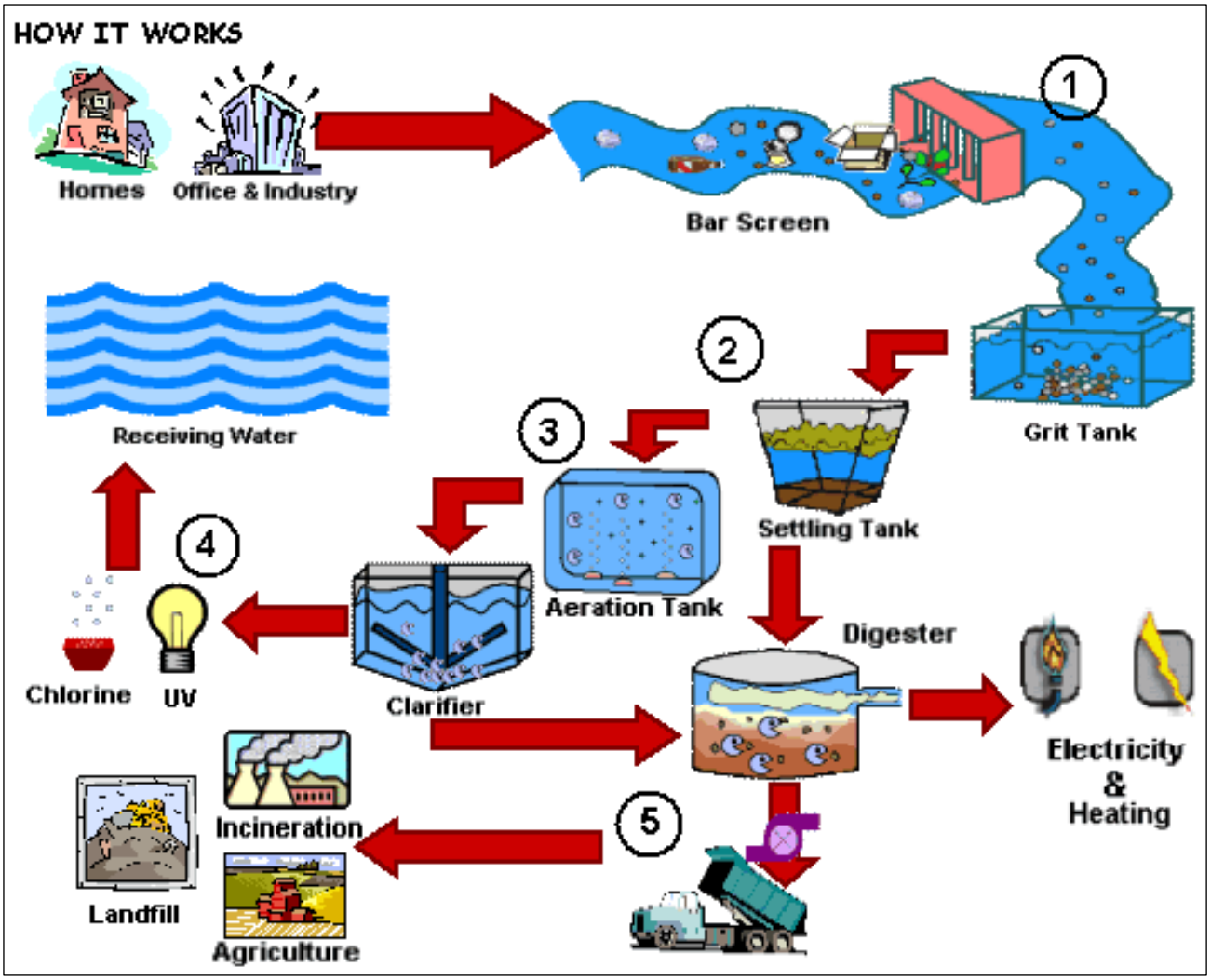
Why Do We Need to Treat Wastewater?

All living organisms need water to survive. We cannot create new water; all the water in the world gets recycled over and over in the **global water cycle**. So, there is only a limited amount of water available for all living creatures to share. We are responsible for cleaning up the water that we make dirty so that living things will have the clean water they need to live and fulfill their roles on the Earth. When wastewater does not get treated, lakes, rivers and streams can get so contaminated that **aquatic organisms** (creatures that live in water) die, and people who try to use the water get sick. If untreated wastewater reaches surface water or food sources (such as agricultural fields), it can infect people with dangerous **pathogenic** microorganisms which cause such severe diseases as malaria, influenza, tuberculosis, cholera, smallpox, and typhoid fever. These diseases continue to produce illness and death among many millions of people worldwide, especially in places where wastewater treatment is not available.

Prior to 1970, the Cuyahoga River in Cleveland, Ohio was so contaminated with oils and debris that it actually *burned*! Photo courtesy of http://www.jcu.edu/chemistry/naosmm/2007/Cuyahoga%20Revisited.htm

In 1972, the Clean Water Act set water quality standards for wastewater treatment to protect public health and to prevent contamination of surface waters in the United States. At the West Boise Wastewater Treatment plant, cleaned wastewater is discharged (or released) directly into the Boise River. The health of the river downstream from the discharge point, or **effluent outfall**, is a direct reflection of how clean we make our wastewater!

How Is Wastewater Cleaned?



The image above suggests typical methods for each stage of treatment. Image courtesy of www.city.toronto.on.ca

5 Stages of Wastewater Treatment at the West Boise Wastewater Treatment Plant:

1. **Preliminary Treatment:** Raw sewage from homes and industry, called **influent**, enters the treatment plant though large underground intake pipes. Large solid objects (greater than 1/4 inch diameter) such as toilet paper, rags and plastic are caught in **Bar Screens**, while smaller solids like sand and coffee grounds settle out of slowly flowing water in the **Grit Tank**. These solids are taken to the landfill. The screened liquid waste moves on to **Primary Treatment**.

2. **Primary Treatment:** In a Primary Clarifier, or settling tank, gravity allows fine solid particles (like poop and dirt) to settle out of liquid to the bottom of the tank to become **sludge**, while oil, grease and fats float to the liquid surface as **scum**. The scum is lighter than water, which is why it floats. The sludge is heavier than water, so it sinks. This physical process is called **separation**. Sludge and scum are channeled to the **Digester**, while the remaining liquid goes on to **Secondary Treatment**.

3. **Secondary Treatment:** Dissolved organic materials such as urea, sugars, proteins, and some **pharmaceuticals** (medicines) in wastewater are consumed by **aerobic microorganisms** (microorganisms are living creatures that are too small to see with the naked eye, and aerobic means that they need oxygen) in **biological treatment** (treatment performed by living organisms). The microorganisms occur naturally in wastewater; we have microorganisms in our intestines, and when we go to the bathroom they go into the toilet with our waste. In the **Aeration Tank** air is added to the water to provide oxygen to these microorganisms, as well as to mix waste and microorganisms together. This mixture moves on to the **Secondary Clarifier** (right), where the masses of waste-filled microorganisms sink to the bottom as sludge, leaving cleaner, clearer water above. Some microorganisms in sludge at the bottom of the clarifier are sent back to the **Aeration Tank** to continue working. The remaining water goes to **Final Treatment**.

Free-swimming ciliates. http://media.wiley.com/product_dc 71206911

Secondary clarifier. Image courtesy of City of Boise

4. **Final Treatment:** Wastewater is disinfected by ultraviolet (UV) radiation. UV radiation is a type of electromagnetic radiation (a wave of energy) much like visible light that makes up the colors of a rainbow; the

difference is that ultraviolet waves are too short for our eyes to see. UV radiation is part of the sun's energy that reaches the earth; you may have experienced the effects of too much UV radiation if you have had sunburn! When pathogens (disease-causing bacteria and viruses) are exposed to direct UV radiation, they are **sterilized** (they can no longer reproduce). By stopping the pathogens from reproducing, we effectively disinfect the water. Disinfection is a very important step in wastewater treatment because it prevents downstream water users from contracting waterborne infectious diseases. Wastewater disinfection also helps prevent the buildup of toxic microorganisms in fish, shellfish and other aquatic creatures. Since the water from final treatment is discharged directly into the Boise River as **effluent** (water leaving the treatment plant), it is critical that it be thoroughly disinfected after Final Treatment! The treatment plant also reuses some effluent water to irrigate landscaping and flush toilets.

Effluent outfall piont. Photo courtesy of City of Boise.

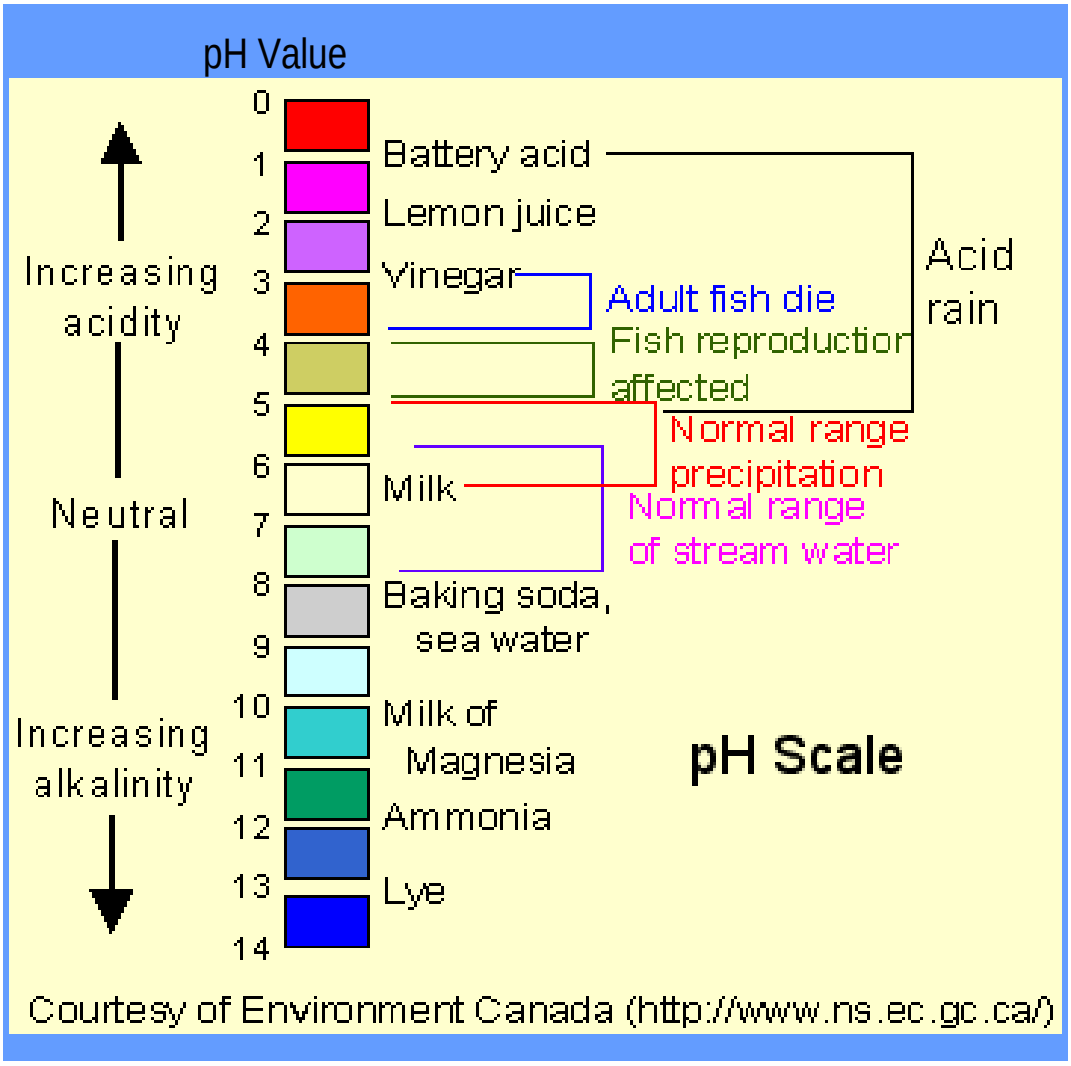
Some wastewater treatment plants disinfect their water by adding a toxic chemical called chlorine. This process, called **chlorination**, chemically kills nearly all of the harmful microorganisms in wastewater. However, chlorine can react with organic materials in water to produce potentially harmful chemical byproducts. Because aquatic organisms can be especially sensitive to the byproducts of chlorination, the West Boise Wastewater Treatment Plant does not use chlorine to treat the water we discharge into the Boise River. Our effluent is clean, but it is not clean enough to drink! Some contaminants that are not removed by our treatment process include bacterially produced toxins, pesticides, hormones and pharmaceuticals. The only way we can keep such contaminants out of our rivers and oceans is by **not** putting them down the drain in the first place!

Gas Sphere. Image courtesy of City of Boise

5. Solids Processing: Solids separated out in Primary and Secondary Treatment are sent to the Digester, where **anaerobic microorganisms** (anaerobic means they don't use oxygen) consume the organic

material and produce **methane gas**. Did you know that when people "pass gas" they are releasing methane gas into the atmosphere? The methane gas produced by microorganisms at the plant is collected in a **Gas Sphere** and is partially reused to heat the Digesters and the Water Quality Laboratory. Digestion removes about 99% of pathogens and converts solid waste to **biosolids** which contain about 98% water. Powdered polymer is added to the biosolids as a thickener, and then the water is both squeezed out in a **belt press** and spun out in a **centrifuge**. This removes about 87% of the water. At the West Boise Wastewater Treatment Plant, dewatered biosolid material called "cake," which is rich in nutrients and smells like compost, is then applied to the nearby Twenty-Mile South Farm as an agricultural fertilizer. The crops produced by the fertilizer include corn, grain, alfalfa and mint. These groups are then sold to local farms for animal feed.

What is the pH Scale?



The **pH scale** measures the acidity or alkalinity of a substance. **"Acidic"** and **"alkaline"** (also called "basic") are two terms that describe chemical properties of a solution. The pH scale ranges from 0 to 14. A pH of 7 is neutral, meaning neither acidic nor basic. A pH less than 7 is acidic, and a pH greater than 7 is basic.

Aquatic organisms can be poisoned if the water they live in has a pH that is too acidic or too basic. Thus, pH is an important indicator of how healthy the water is for organisms that depend on it; this is also called **water quality**.

Wastewater Treatment Standards
(How well do we have to treat wastewater?)

The City of Boise must comply with water quality standards set by the United States Environmental Protection Agency (EPA) and Idaho Department of Environmental Quality (DEQ). A permit that defines limits for certain pollutants allows us to discharge treated wastewater into the Boise River. Throughout the treatment process, wastewater is analyzed in our on-site Water Quality Laboratory. The laboratory tests for temperature, pH, and amounts of total suspended solids (TSS), fecal coliform bacteria, dissolved oxygen (DO), biochemical oxygen demand (BOD), and metals such as mercury and copper. Additionally, the Boise River is sampled every week above and below the **effluent outfall points** (places where pipes discharge treated effluent to the river). The river water samples are also tested for pH, temperature, DO, BOD, TSS, and specific conductivity. The City of Boise reports these test results to the EPA to ensure that we are in compliance with water quality standards.

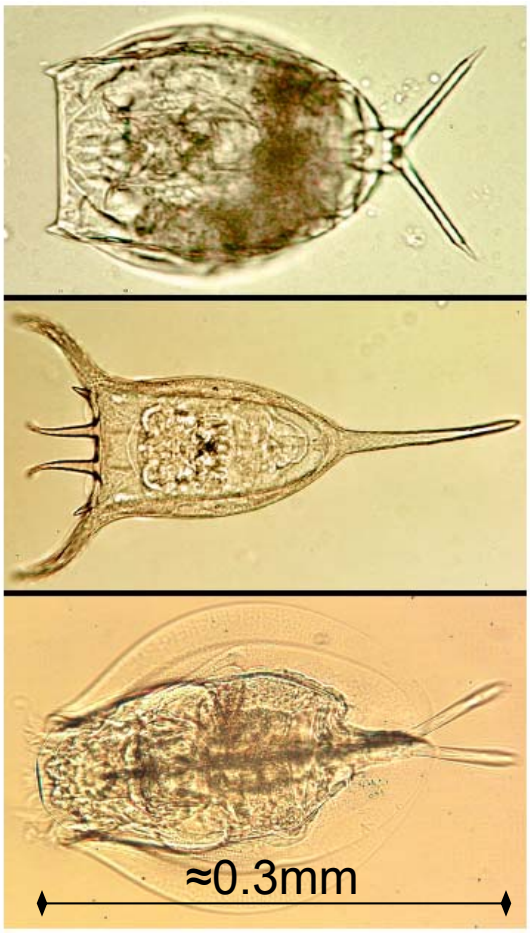
There are certain "pollutants" that are not addressed by national or state water quality standards and thus, we have no current treatment for them. These pollutants include prescription medications, endocrine disrupters, caffeine, and flame retardants to name a few. These **emerging contaminants** are currently being studied by EPA and the United States Geological Survey (USGS) to learn more about their effects on fish and aquatic life.

What are Microorganisms?

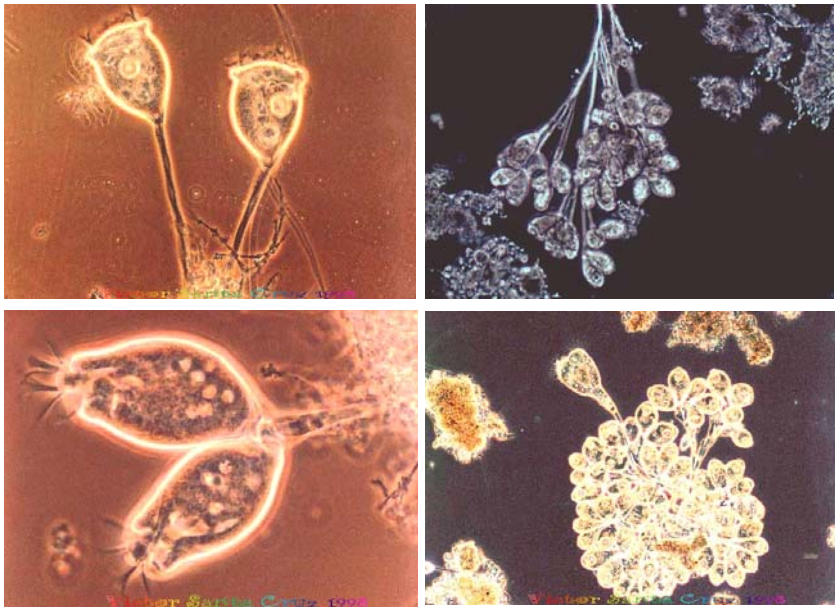
Microorganisms are living creatures that are too small to be seen with the naked eye. They include algae, bacteria, fungi, protozoa, and viruses. Despite their small size, microorganisms are essential to the environment, to our lives, and to the fields of water and wastewater treatment. In the water treatment plant, we use ultraviolet radiation or chlorine to effectively kill the pathogenic bacteria by halting their reproduction. On the other hand, the wastewater treatment plant uses other, helpful bacteria to break down and consume organic waste, thereby cleaning the water.

Meet the Microorganisms in Wastewater!

Rotifers are tiny, transparent creatures made of about 1000 cells. They have organs including a brain, stomach, excretory system and reproductive system. Although they come in many forms, rotifers generally have crown of hair-like **cilia** on the front of their body which they use to grab food, as well as to propel themselves to around through the water. Rotifers help clean wastewater by eating suspended organic particles and free-swimming algae.



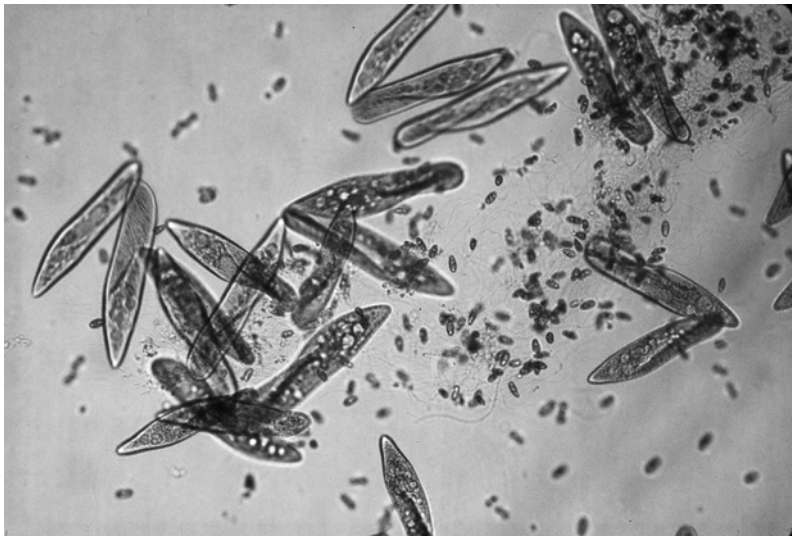
Rotifers. Image courtesy of http://cfb.unh.edu/CFBkey/html/anatomy/rotiferA/rotifer_ana_a_no_labels.jpg



Stalked ciliates. Images courtesy of http://www.environmentalleverage.com/Stalked%20Ciliates.htm and http://home1.gte.net/vsjslsk1/stalkedciliates.htm

Ciliates are **unicellular** (composed of 1 cell) organisms from 0.01 to 3 mm long which have hair-like **cilia**. **Stalked ciliates** have cilia around their mouths which help them to move and gather food. They also have a stalk which they use to anchor themselves to stable material, much like a plant is anchored to the ground (for example, celery grows as stalks).

Free-swimming ciliates have bodies covered in rows of cilia. These cilia allow them to swim around to find their food. Ciliates help in wastewater treatment by eating suspended organic materials and binding fine (very small) waste particles into individual or colonies of ciliates. As the ciliates grow, they can collect into heavy, semi-solid masses called "floc" which then settle out of the water. Ciliates also recycle nutrients, such as nitrogen and phosphorous, through their excretions.

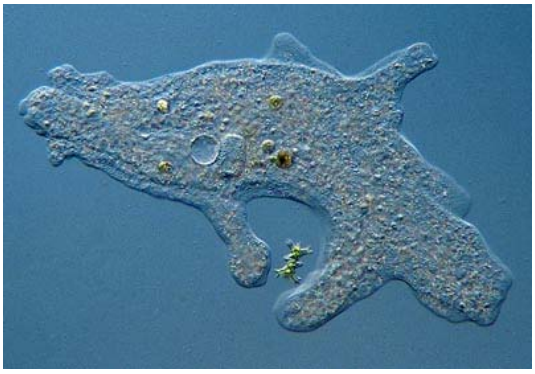


Free-swimming ciliates. Image courtesy of http://media.wiley.com/product_data/excerpt/11/04712069/0471206911.pdf

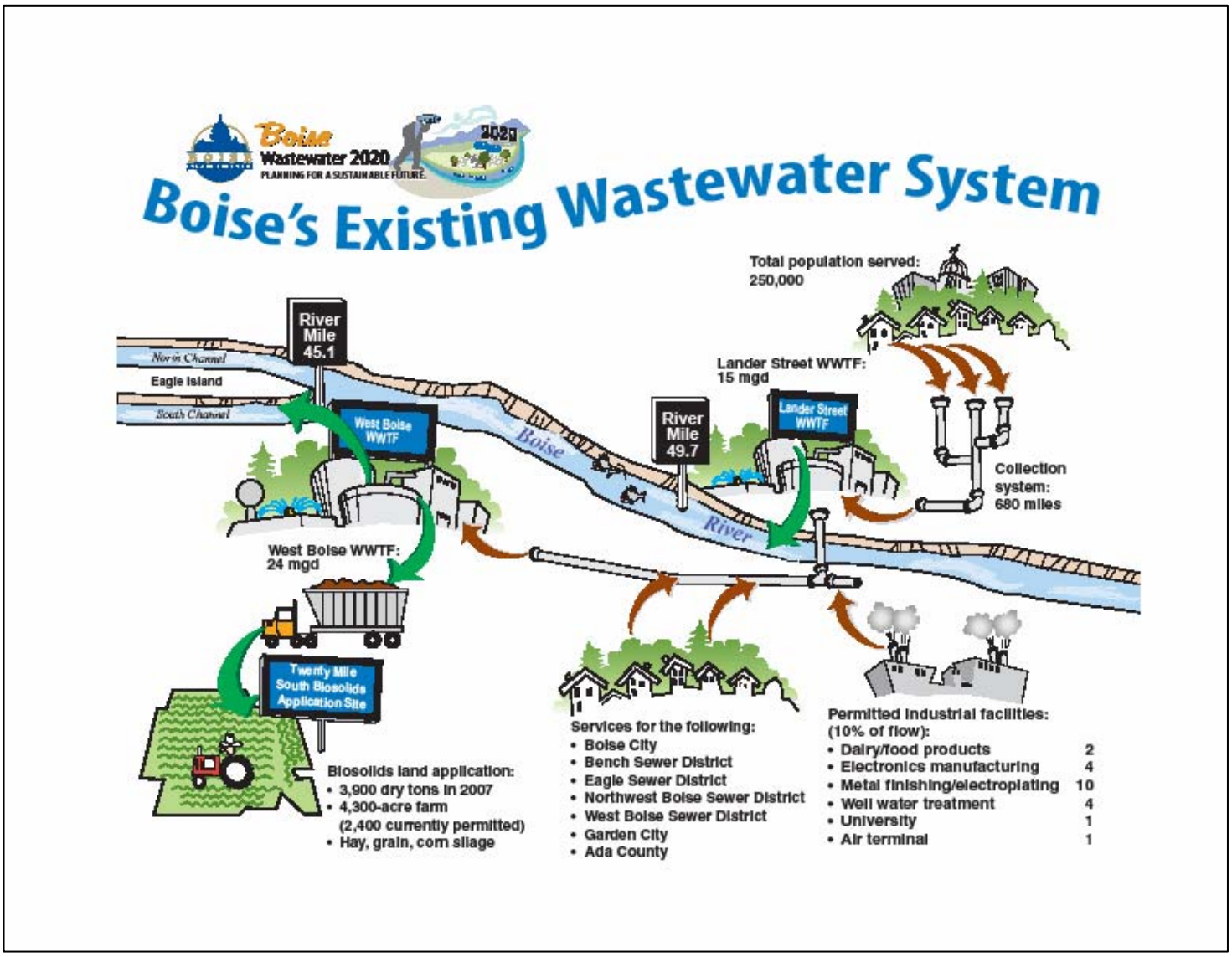
Flagellate. Image courtesy of http://www.microscopy-uk.org.uk/index.html?http://www.microscopy-uk.org.uk/pond/protozoa.html.

Flagellates are unicellular organisms usually less than 0.4 mm long which propel themselves through water using a whip-like structure called a **flagellum**. Flagellates can survive in anaerobic (oxygen-free) conditions. Several flagellates are pathogens for humans. An abundance of flagellates indicates that wastewater is unstable or incompletely treated.

Amoebae are unicellular organisms which move around using **pseudopodia** ("false feet"). Amoebae can be 0.02 to 5 mm wide, and they eat by **engulfing**, or wrapping themselves around, their food particles. Amoebae can be pathogenic to humans, and abundant amoebae in wastewater can indicate incomplete treatment.



Amoeba engulfing prey. Image courtesy of http://www.microscopy-uk.org.uk/index.html?http://www.microscopy-uk.org.uk/pond/protozoa.html.



Our Boise River

In the late 1950s, the lower Boise River was identified as one of the three most polluted rivers in Idaho. Today, the Boise River is one of the true treasures of Treasure Valley thanks to wastewater treatment and other human efforts to clean up the river. The City of Boise has two wastewater treatment plants, West Boise and Lander Street. The Lander Street Wastewater Treatment plant was built in 1949 and placed online in 1950. The West Boise Wastewater Treatment Plant was initially completed in 1976, but is continuously being modified and expanded to this day. We provide sewer service for Bench Sewer District, Northwest Boise Sewer District, West Boise Sewer District, Boise City, Garden City, and Eagle (Meridian and Eagle have their own treatment plants). If you stretched out all the pipes in the Boise sewer system end-to-end, they would reach from here to Seattle! The value of the wastewater treatment plants and sewers is well over $350 million. The City of Boise has an average combined flow of 26-30 mgd (million gallons per day). The flow is split between the two treatment plants. During the winter, the two treatment plants double the flow of the Boise River. The maximum flow through the City's plants is 40 mgd.

Which day of the year do you think has the highest flow? It happens once a year – on an unofficial American holiday… take a guess…

(Super Bowl Sunday!)

Cleaned water from the wastewater treatment plant is discharged directly to the Boise River from a pipe at the treatment plant called the **effluent outfall** point. This effluent is treated specifically to meet the needs of all the stream users, including fish and wildlife such as bull, rainbow, and cutthroat trout, elk, black bear, and bald eagles - and of course, people! The Boise River provides more than 20% of Boise's drinking water and irrigation for 300,000 acres of crops in Idaho's Treasure Valley. The river is also a popular destination for rafting, inner-tubing, and fishing.

The Boise River. Photograph courtesy of photos.igougo.com

Because so many creatures depend on a clean, healthy Boise River, we all have a responsibility to make sure that the water flowing to the river is safe and clean! Although our industrial and domestic wastewater are cleaned at the treatment plants, rainstorms and snowmelt produce **stormwater** which flows over our streets, yards, and parking lots to reach storm drains, and is then carried directly to the Boise River, untreated! We can all help keep the Boise River clean by making sure that what we do on the land doesn't pollute the river. By picking up our litter and pet waste, minimizing the amount of fertilizer and pesticides we use, and keeping our cars from leaking oil and gas, we can all play a role in making the Boise River a healthy resource for ourselves and the other creatures that depend on it!

Stewardship

Environmental stewardship is taking personal responsibility for the natural environment. It is up to you and everyone on our planet to take care of our natural resources for today—and tomorrow. Sustainability is widely defined as the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs.

Image courtesy of computing.fs.cornell.edu

How You Can Help

Every person—including you—has the chance to make a difference by practicing environmental stewardship. Look for opportunities at home, at school, at work, in your community, and while shopping and traveling. The possibilities are endless, and the cumulative impacts of individual actions can really add up.

Dispose of Hazardous Materials Properly - Pouring hazardous materials into the sewage system can be as dangerous as pouring them right into the Boise River.

Image courtesy of Ada County, http://www.adaweb.net/departments/solidwastemanagement/DisposeOfHouseholdHazWaste.asp

Wastewater treatment does not remove most household, automotive, or lawn and garden hazardous chemicals. These chemicals can kill the beneficial microorganisms used to treat wastewater, corrode the sewer pipes, and seriously contaminate the river. Automotive products, cleaning products, lawn care products, workshop materials, and household materials like shoe polish, rodent poison, aerosols, pool chemicals, and prescription drugs can pollute the river and impede the wastewater treatment process. You can minimize your use of such products, and choose environmentally safe alternatives to them, such as baking soda instead of harsh cleansers. When you dispose of such materials, take them to the Ada County Household Hazardous Materials Collection Facility, or look for the mobile collection vehicle shown in the picture. The facility also offers a free material reuse program, where unused portions of hazardous materials can be donated and obtained free of charge!

Join a citizen water monitoring group - Take a snapshot of the health of the Boise River watershed by monitoring water quality. Citizen groups, families, schools and individuals may check out a water quality testing kit throughout the year from the Boise WaterShed. Each group will be provided with a basic water quality testing kit to test the water's temperature, pH, dissolved oxygen and turbidity. Sign up today by calling the Boise WaterShed at 489-1284 or send an e-mail to BoiseWaterShed@cityofboise.org. You can also contact the Boise WaterShed to find out when they plan to host a community-wide Citizen Monitoring Day event.

Mark storm drains in Boise – Storm drain marking is a visible reminder that storm drains are for stormwater only. Marking involves people, educates and increases awareness about the importance of the river and helps preserve the environment. Contact Aimee Hughes, Environmental Education Specialist with Boise Public Works at 384-3901 or send an e-mail to AHughes@cityofboise.org to reserve marking kits. Aimee will assist you with selecting an area in town that needs marking, such as neighborhoods, shopping malls or parking lots.

Image courtesy
Partners for Clean Water

Clean up a designated area - Any day of the year, you can call the Boise WaterShed for gloves and trash bags for a cleanup. The Boise RiverSweep is an annual event the second Saturday in September designed to give back to the river that gives so much to us. Volunteers, students, and concerned citizens join together to clean up the Boise River to help provide a safe and clean Boise River for our community to use for many generations to come. The City of Boise's Adopt the Greenbelt program is designed to help keep the Greenbelt and Boise River clean and safe to use. As a participant, you can adopt a 1/2 to 2/3 mile section of the Greenbelt to inspect and care for throughout the year. This program allows you to work when your schedule allows. To find out more about Boise RiverSweep or Adopt A Greenbelt, contact Jerry Pugh at 384-4060, Ext. 319.

Image courtesy of City of Boise

Student Activity

Name_____

Wastewater: We Treat it Right! Vocabulary Matching Game

Match each word to its definition by writing the letter of the word next to its correct definition on the right.

A. Pathogen

B. Water Quality

C. Contaminant

D. Secondary treatment

E. Microorganisms

F. Influent

G. Settling

H. Domestic Wastewater

I. Stewardship

J. pH Scale

K. Stormwater

___ A measure of how healthy the water is for organisms that depend on it.

___ Stage of wastewater treatment in which biological treatment in the presence of air is used to break down dissolved organic wastes.

___ Taking personal responsibility for, and caring for, our natural resources.

___ Living creatures which are too small to be seen with the naked eye, such as algae, bacteria, fungi, and viruses.

___ Raw sewage from homes and industry that enters the treatment plant though large underground intake pipes.

___ Rain water which flows over our streets, yards, and parking lots to reach storm drains and is then carried directly to the Boise River.

___ Disease-causing bacterium or virus.

____An indicator of water quality, this is a measure of how acidic or basic water is.

___ Physical process by which solid materials sink to the bottom of a liquid.

___ A used liquid you flush down your toilet and what drains from your bathtub, sink, and washing machine.

___ A substance that can produce a negative effect in a natural system if enough of it is present.

Student Activity

Name_____

Wastewater: We Treat it Right! Lesson Review

1. List the 5 main stages of wastewater treatment:

1. _____

2. _____

3. _____

4. _____

5. _____

2. Where does wastewater come from?

_____
_____
_____
_____.

3. How does physical treatment differ from biological treatment?

_____
_____
_____
_____.

4. What do you think would happen if we did not treat our wastewater?

_____
_____
_____
_____.

5. How does Primary Treatment differ from Secondary Treatment?

_____
_____
_____
_____.

6. How is water from the Boise River used, and by whom?

_____
_____
_____
_____.

7. What is the pH scale used for?

_____
_____
_____
_____.

8. Are microorganisms good or bad for us?

_____
_____
_____
_____.

9. What is the difference between wastewater and stormwater?

_____
_____
_____
_____.

10. Why should you practice environmental stewardship?

_____
_____
_____
_____.

Three Ways I Pledge to Keep the Boise River Clean:

1. _____
   _____
2. _____
   _____
3. _____
   _____

Answer Keys

Wastewater: We Treat it Right! Vocabulary Matching Game

A. Pathogen: Disease-causing bacterium or virus

B. Water Quality: A measure of how healthy the water is for organisms that depend on it.

C. Contaminant: A substance that can produce a negative effect in a natural system if enough of it is present.

D. Secondary treatment: Stage of wastewater treatment in which biological treatment in the presence of air is used to break down dissolved organic wastes.

E. Microorganisms: Living creatures which are too small to be seen with the naked eye, such as algae, bacteria, fungi, and viruses.

F. Influent: Raw sewage from homes and industry that enters the treatment plant though large underground intake pipes.

G. Settling: Physical process by which solid materials sink to the bottom of a liquid.

H. Domestic Wastewater: What you flush down your toilet and what drains from your bathtub, sink, and washing machine.

I. Stewardship: Taking personal responsibility for, and caring for, our natural resources.

J. pH Scale: An indicator of water quality, this is a measure of how acidic or basic water is.

K. Stormwater: Water which flows over our streets, yards, and sidewalks to reach storm drains and is then carried directly to the Boise River.

Wastewater: We Treat it Right! Lesson Review

1. Preliminary Treatment, Primary Treatment, Secondary Treatment, Final Treatment, Solids Processing.

2. Homes, businesses, and industry; bathrooms and kitchens, sinks, toilets, bathtubs, etc.

3. Physical treatment uses physical characteristics like density and particle size to separate materials, while biological treatment uses living organisms (biology) to convert or consume substances (to be settled out as solids).

4. The water would be soiled with raw sewage, which could harm or kill the organisms that need it, such as aquatic organisms and even people; the river would be too dirty to use or enjoy.

5. Primary treatment uses physical treatment (settling, floating, screening), while secondary treatment uses physical and biological treatment (aerobic microorganisms).

6. Fish, birds, mammals, amphibians, reptiles, insects, macroinvertebrates, microorganisms, people. For living in, drinking, playing in, drinking, transportation, laying and hatching eggs, etc.

7. To indicate water quality (how healthy the water is for its end users), to measure how acidic or basic water a material is.

8. Both- there are lots of different kinds of microorganisms. Some are pathogenic, meaning they can cause disease, but others are helpful to us and can break down unhealthy waste materials. They also live in our bodies and help us to digest food and survive.

9. Wastewater gets treated at a wastewater treatment plant before reaching the Boise River. Stormwater flows from streets, yards, and parking lots directly to the river, untreated.

10. Every person has a responsibility to protect our water supply, because all life depends on water. By keeping our water clean, we are helping ourselves, and all the other creatures that we depend upon and share the Earth with, to live healthy lives!

Boise WaterShed Library Resources

Take advantage of these FREE resources available for check-out from the Boise WaterShed Library Resource Center. Call (208) 489-1284 to reserve for a two-week period.

Videos, DVDs & Software

- Biosolids: The Growth of Recycling VHS by Northwest Biosolids Management Association, 1997, 15 minutes
- Modern Marvels: Sewers DVD by the History Channel, 2005, 50 minutes

Educator Resources

- EcoArt! Earth-friendly art and craft experiences for 3- to 9-year-olds by Laura Carlson, 1993
- Earth Book for Kids: Activities to Help Heal the Environment by Linda Schwartz, 1990
- Organic Crafts: 75 Earth-friendly Activities by Kimberly Monaghan, 2007
- Project Wet Curriculum & Activity Guide, Project WET International/CEE, 2008. For example, refer to Sparkling Water activity, p. 348-352.

Kids Books

- Where Does The Poo Go When You Flush? By Caren Trafford and Jade Oakley, 2003
- World-wide Waste by Caren Trafford, 2006
- Flush! Treating Wastewater by Karen Mueller Coombs,

Other Books

- The Green Consumer by John Elkington, Julia Hailes and Joel Makower, 1998
- Basic Microbiology for Drinking Water Personnel, by Dennis R. Hill, 2006
- Handbook of Water Use and Conservation, by Amy Vickers, 2002

Magazines

- Water & Wastes, March 2008, Managing Energy: Exploring Energy-efficient technologies in water and wastewater treatment
- Water Efficiency, May/June 2008, Ultimate Recycling: Cutting Edge Water Management in Orange County
- Water, Environment & Technology, May 2006, Reuse on the Rise: Implementing a viable reclamation program
- Water, Environment & Technology, April 2007, Living Large: Expanding Digester Capacity to Meet Growing Demands
- Water, Environment & Technology, August 2007, Recycle, Reclaim, Reuse: Balancing Water Supply and Demand
- Water, Environment & Technology, May 2003, Rising to the Occasion: Anaerobic digestion may be a viable option for producing Class A biosolids

Kits/Models

- EnviroScape Wastewater/ Drinking Water Treatment Model

Internet Resources

About Wastewater Treatment

http://wef.org/apps/gowithflow/theflow.htm
The **Water Environment Federation** has provided an excellent interactive map of the wastewater treatment process called Go With the Flow. Highly recommended as a demonstration subject and resource.

http://www.sandiego.gov/mwwd/kids/ Wastewater… Sewage in Your Face! A fun, interactive and comprehensive site of lesson plans, activities, information and links related to wastewater treatment from the **City of San Diego**.

http://www.metrocouncil.org/environment/kids/index.htm
The Metropolitan Council of St. Paul, MN treats wastewater in the seven-county metro area. Wastewater Treatment for Youngsters is a fun slideshow that brings viewers along with wastewater on its path from homes, through the treatment plant, and to the Mississippi River. Additional illustrated topics include the water cycle and watersheds.

http://seagrant.mit.edu/education/resources/bostonsewage/introduction.html
The Boston Sewage Tour provides an in-depth exploration of wastewater treatment in general, and a useful case-study of the evolution of wastewater treatment in the heavily populated Boston Harbor region.

http://www.adaweb.net/departments/solidwastemanagement/HouseholdHazMatCollection.asp
The **Ada County Household Hazardous Materials Collection Facility** makes it easy to reuse or properly dispose of your household hazardous wastes.

http://www.recycle-more.ca/nimby_online_game.html **NIMBY (Not in My Back Yard)** game for all ages teaches and quizzes players on responsible ways to consume, conserve, and avoid reaching the landfill for as long as possible!

Free Resources and Activities

http://water.usgs.gov/outreach/OutReach.html
The **U.S. Geological Survey** provides multiple water-related posters free for downloading.

http://environment.gov.ab.ca/edu/posting.asp?assetid=6270&audience=Teachers&head=ED
From **Alberta Environment**, a booklet of tips and strategies that everyone can use at their own home and office!

http://www.adaweb.net/departments/solidwastemanagement/HouseholdHazMatCollection.asp

The **Ada County Household Hazardous Materials Reuse Program** allows citizens to obtain and recycle their unused household hazardous materials FREE of charge! Products that are in their original container, at least one-half full, and that have not been altered (or banned), are placed on shelves in the Facility for the public to take for FREE. Paints, herbicides, pesticides, fertilizers, lubricants, and cleaning supplies are just a few of the materials that can be freely obtained or donated through this local program.

Environmental Stewardship

http://www.epa.gov/stewardship/

The **U.S. Environmental Protection Agency** provides a comprehensive overview of environmental stewardship. Individuals, communities, businesses and institutions, as well as governments can all practice environmental stewardship. Tips are provided on how to practice stewardship in the home, at work, as school, in the community and while shopping.