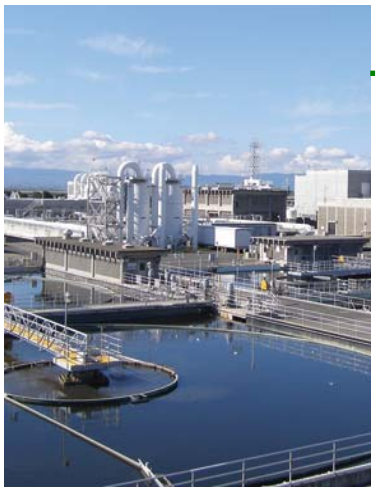
Union Sanitary District

Protecting Human Health and the Environment for Fremont, Newark, and Union City.

GRADE 5 LESSON PLANS

Inside this workbook



Union Sanitary District
Alvarado Plant in Union City, CA

USD 5th Grade Water Presentation

The Union Sanitary District is providing these ideas and lesson plans so you can better prepare your students for our visit and to extend the lesson after we leave.

All students and their parents in Fremont, Newark and Union City use our services every day, but are unaware of our role in keeping the creeks, flood control channels and waters of the bay clean.

USD 5th Grade Classroom Presentation Standards

We can help you meet the new Next Generation Science Standards

The Next Generation Science Standards are being rolled out over the next two years. The Union Sanitary District 5th Grade Presentation and this Teacher Workbook have been designed to assist you in meeting these Next Generation Science Standards:

5-ESS2-1. Develop a model using an example to describe ways the geosphere, hydrosphere, biosphere and/or atmosphere interact.

5-ESS2-2. Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

5-ESS3.C. Human impacts on Earth Systems

5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

How the USD Presentation meets Next Generation Science Standards

The beginning question/answer session introduces students to the **Sanitary Sewer**, **Storm Drain** and Fresh Water systems. Students learn what forms of water go where. This is related to **5-ESS3.C**.

The video session is also related to **5-ESS3.C** as it shows how a **wastewater treatment plant** functions and why it is so important.

The placemat exercise reinforces the introductory session by getting students to find positive and negative human impacts on water in the towns we live in. This is also related to **5-ESS3.C**.

The stormdrain pollution experiment supports **5-PS1-4**. The food coloring and water are mixed to demonstrate that a small volume of **pollution** can have a large effect. The substances mix and the color of the water changes but no new products are formed.

Union Sanitary District's Outreach

Union Sanitary District's Elementary School Outreach program is committed to educating young students on the importance of keeping **pollutants** out of the sanitary and storm drain systems and the San Francisco Bay. This will be accomplished by teaching students the difference between the systems and how we can **prevent** polluting both of them.

Urban **runoff** is a major problem for stormdrains. **Pollutants** are carried by **runoff** from streets, roadways, commercial and industrial sites. Our homes can also be sources of **pollutants** to be carried by **runoff**. Our cars, household cleaning products, and garden chemicals can all enter the stormdrains with rain and when we over water our gardens.

Through this educational outreach effort Union Sanitary District expects to **reduce** the amount of **pollutants** entering local creeks and ultimately the San Francisco Bay.

Also, by reducing the volume of **pollutants** entering the Alvarado Treatment Plant, we will **reduce** the amount of **pollutants** that end up in landfills, the Hayward Marsh and the San Francisco Bay.

Outreach Team (from left)— Audrey Villanueva, Jason Yeates, Doug Dattawalker and Marian Gonzalez

VOCABULARY

BIOSOLIDS - The solids that are the final product of our treatment process. They are disposed of in landfill or land applied

DISCHARGE - water that is released from where it is being held

DISINFECT - to destroy harmful bacteria or pathogens

EFFLUENT - water from a treatment plant or manufacturing facility that is discharged into the environment

HERBICIDE - an agent that is used to destroy or limit plant growth

PATHOGEN - any biological agent that can cause diseases

PESTICIDE - a chemical that is used to kill insects and other pests

POLLUTANTS - a chemical or other substance that can cause damage to the environment

PREVENT - to stop from happening

REDUCE - to make less

RUNOFF - water that flows over the ground towards a storm drain

SANITARY SEWER SYSTEM - an underground system of pipes that carries wastewater from homes and businesses to a treatment plant

STORM DRAIN SYSTEM - a system of underground pipes that carry rain water to creeks, streams, flood control channels and the San Francisco Bay

WASTEWATER - water that has been used by humans to clean, wash or flush at homes or businesses

WASTEWATER TREATMENT PLANT - the facility where wastewater gets cleaned so that it can be released back to the environment

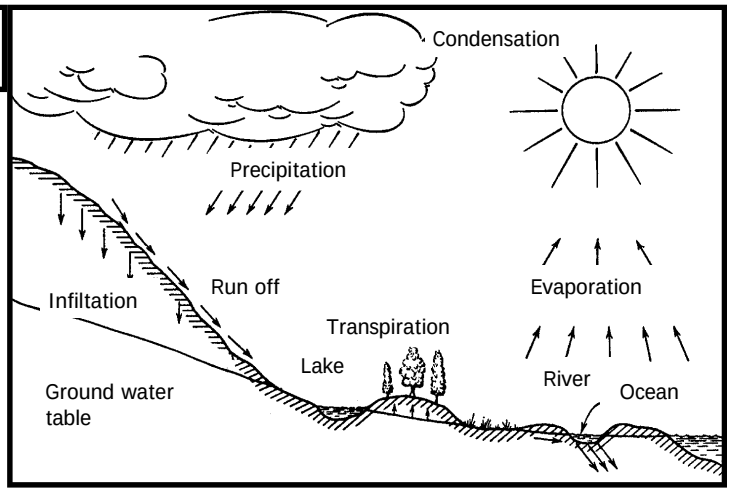
WATER CYCLE - the movement of water through the natural environment as it condenses from gaseous water in the atmosphere to liquid rain or freezes to solid snow and ice. As it flows through rivers and streams, soaks into the ground, and evaporates back to the atmosphere

WATERSHED - a geographic region where all the water that falls as rain drains to a single river or body of water

Water Cycle

5-ESS2-1.
Students should know the parts of the **water cycle**. This exercise links water moving through the **water cycle** with water moving through the biosphere.

1. Water **precipitates** from clouds as rain, snow, sleet, or hail to the Earth's surface.
2. Depending on a number of factors such as soil type, slope, moisture conditions, and intensity of precipitation, water will either **infiltrate** into the ground or **runoff** into rivers and streams. Virtually no water infiltrates through paved roads and parking lots, so almost all of it becomes urban **runoff**.
3. **Runoff** from rivers, and streams is stored in large bodies of water such as lakes, estuaries, and the San Francisco Bay.
4. Water is returned to the atmosphere either through **evaporation** from the surface of land or water bodies, or through plants by a process called **transpiration.**
5. Clouds are formed by **condensation** of water vapor that evaporated from the land or oceans
6. Clouds are blown over the land by local winds



This "cycling" of water is continuous. Water is perhaps the ultimate example of recycling.

Water moving through systems

5-ESS2-1.
This experiment shows how the hydrosphere and biosphere interact by experimenting with plants and food coloring and how water can travel through the plant.

Introduction

Ask students about water moving through plants and animals. How does water get into our bodies? We drink it. How does it get into plants? It gets soaked up through the roots and into the stalk (this can be drawn into **water cycle**).
Water is used to transport things around the body. Humans drink water and take it into our blood which is mostly water. Our blood transports food and materials around our bodies. Plants soak water up through their roots and use the water to transport materials throughout their bodies as well.

This experiment demonstrates that water is used to transport materials through plants and therefore is essential to life.

Materials

Celery sticks, cups & food coloring

Method

1. Celery sticks can be cut lengthways so less are needed. They need to have leaves still attached.
2. Pour water into cups so they are more than half full.
3. Add 4 drops of food coloring to cups and stir
4. Cut the bottom end of the celery stalk so that a fresh edge is created
5. Put celery sticks into cups and mark water level
6. Have students write their predictions
7. Allow to sit in bright area for 1 days and make observations
8. Repeat at 2 days
9. Make observations and discuss what is going on.
10. Cut a cross section of the celery stem to view the transport tubes. They will be highlighted in the color of the dye.

Discussion

The water moves up from the roots to the leaves where it transpires back out to the atmosphere. As the water moves it carries the food coloring with it to the leaves. The cross section shows which parts of the celery stalk are responsible for transporting water and materials up the plant.

Water on Earth

5-ESS2-2. This demonstration will show how little water is available for us to use on Earth and links with existing 5th grade math skills.

Scientists present information in different ways. In this exercise students will see a physical model for the distribution of water on Earth. They can then be shown different ways to represent that information such as in a pie chart or bar graph. Finally, they can construct their own bar graphs.

Introduction

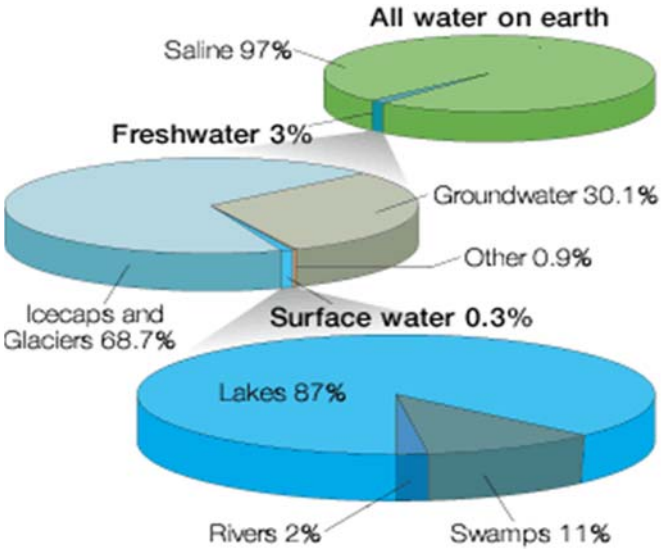
There is a lot of water on Earth! The average depth of the ocean is 1.7 miles, and water covers about 70% of the Earths surface. So, why are we concerned about water shortages? Why are we setting restrictions on how much water we can use at home? Why do we need to think about taking shorter showers? There is actually very little freshwater on Earth and what is available is difficult to get to and use.

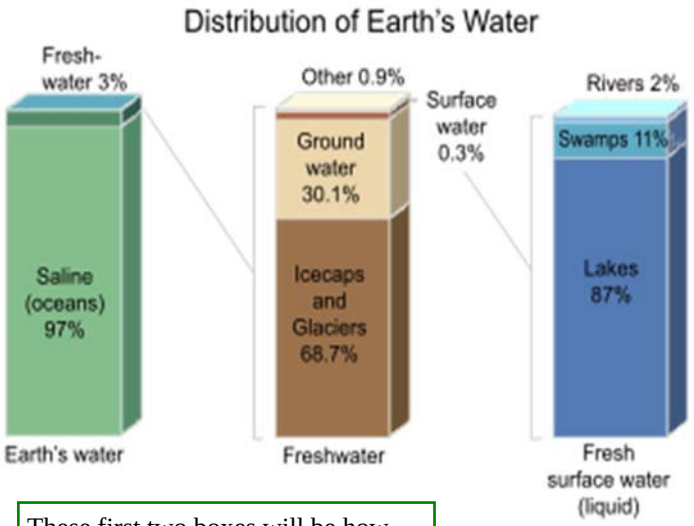
Materials

1L jug or bottle, clear plastic cup, bottle caps, plastic dropper, graph paper

Method

1. Fill the jug with 1L of water. This represents all the water on Earth, oceans, lakes and the atmosphere
2. Pour out 30mL. This represents all the available fresh water on Earth. The remaining 970mL is all salt water, practically unusable though we are developing desalination technologies to make this available. It is not without difficulty though (energy use and brine disposal)
3. From the 30 mL pour out 20 mL to one watch glass, 10mL to another and take the smallest drop possible and place it on your fingertip, or the back of a pen. The 20mL represents the frozen water that is locked up in ice caps and glaciers. Difficult to access or make use of. The 10 mL represents groundwater, just about everywhere there is water saturated deep within the ground. We are getting better at removing it but it is also causing problems such as the permanent volume reductions in aquifers in the Central Valley, California. The drop that is left on your fingertip is all the fresh water in the world in lakes, rivers and streams. This is the majority of what we use.
4. Photocopy the next page and help students transfer information from the tables to the Bar Graphs.





These first two boxes will be how the students bar graphs should look

Water on Earth continued

Distribution of Water on Earth	
Saltwater in Oceans	97%
Freshwater	3%

Distribution of Freshwater on Earth	
Icecaps and Glaciers	68.7%
Groundwater	30%
Other water such as in the atmosphere	1%
Surface water in lakes, rivers and streams	0.3%

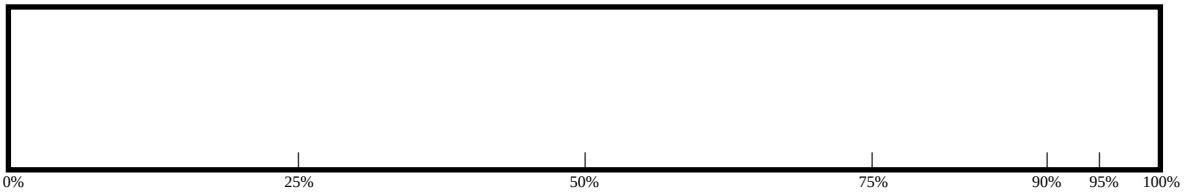
The 3% of freshwater in the first table is the total amount of water used in the second table (100%). To see all the information on a single bar graph the amount of water in surface waters would be less than the width of a single hair.

Instructions

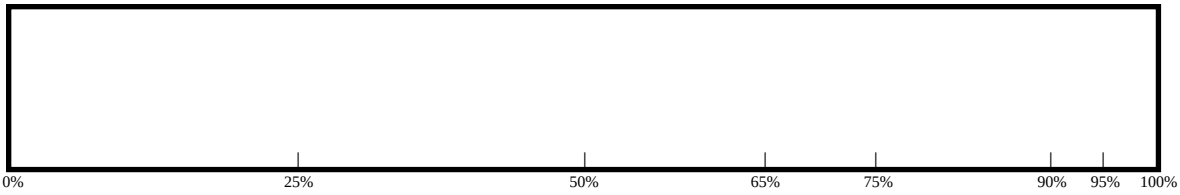
- Use the information in the tables above to create a bar graph for the Distribution of Water on Earth and the Distribution of Freshwater on Earth

Some guidelines have been given and the bars are exactly 6 inches long. You will need to estimate the amount for surface water on the freshwater bar graph because it is very low at 0.3%

Distribution of Water on Earth



Distribution of Freshwater on Earth



Pollutants in the Environment

Your students will each be given a placemat that can help you extend this lesson.

5-ESS3.C.

Have your students list 5 good and 5 bad processes they can find on this placemat. Then discuss why they might be good or bad.
Good examples include; recycling, taking waste to the recycling center, taking waste to the household hazardous waste center, using recycled water from the treatment plant.
Bad examples include; watering sidewalks, washing fertilizer down drain, storing used paint cans etc in garage, draining oil in the driveway, dumping oil/trash behind house
The landfill is both good and bad because we do not really have an alternative for dumping all trash. We need to find better ways to **reduce** the amount of trash we dispose of.

Recycling
Steel cans, glass jars, and various paper products can be recycled. On garbage day you can put them out near the street in the bins provided by your waste management service and they will recycle them for you. This is a way to decrease the amount of garbage going to landfill and it also **reduces** the need for mining or harvesting of precious natural resources. Please recycle!

Household Hazardous Waste Facility
Household chemicals, cleaning products, and paints can be harmful to you and your family. You can dispose of unwanted containers at your local hazardous waste collection service. The filled containers should be used according to manufacturers directions. The storage of these products should be in an area where runoff from sinks and or hoses will not effect the product. Also these materials need to be stored away from small children.

Car Maintenance
Oil and antifreeze that leak out of cars is washed into **storm drains** when it rains. Check your cars for drips and leaks. If you find any, ask whomever is responsible for the car to have the leaks fixed soon!

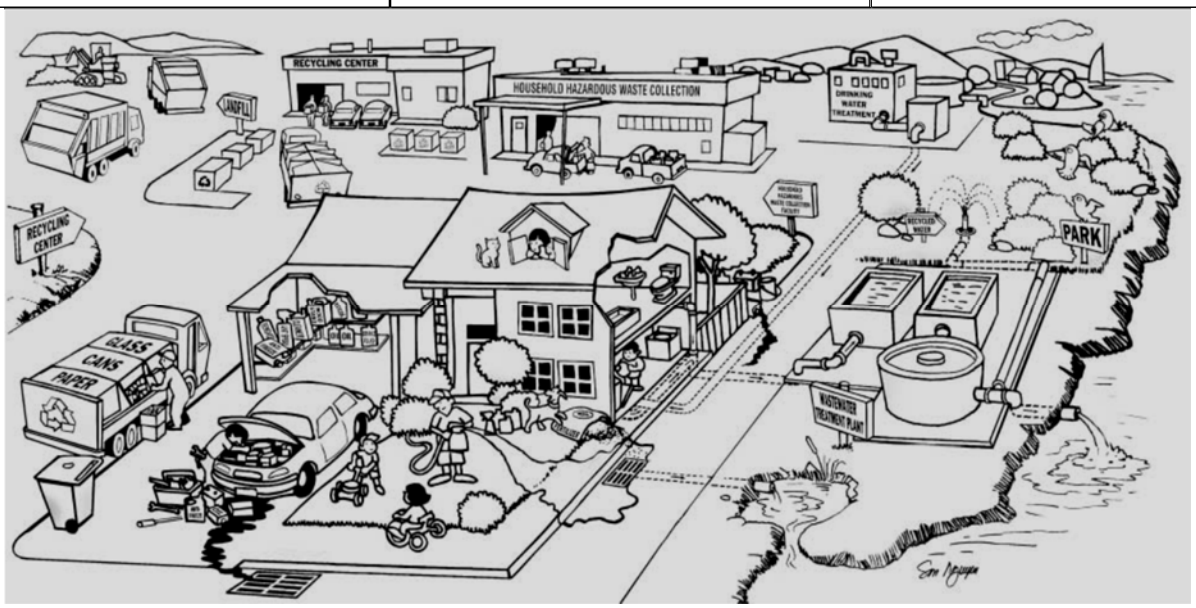
Garden Care
Fertilizers contain large amounts of nutrients such as nitrogen and phosphorous that can wash into lakes and streams, and may cause algal blooms. These blooms use up the oxygen in the water that fish and other organisms need to breathe. When it rains, excess amounts of fertilizers can run off into **storm drains**, roadside ditches, and nearby waterways.

At Home
In your home only a few cleaning products can go down the drain. Most chemicals are harmful to humans and can not be removed at the **wastewater treatment plant.** This is why you should never pour motor oil, antifreeze, **pesticide**, and other household products down the sink.

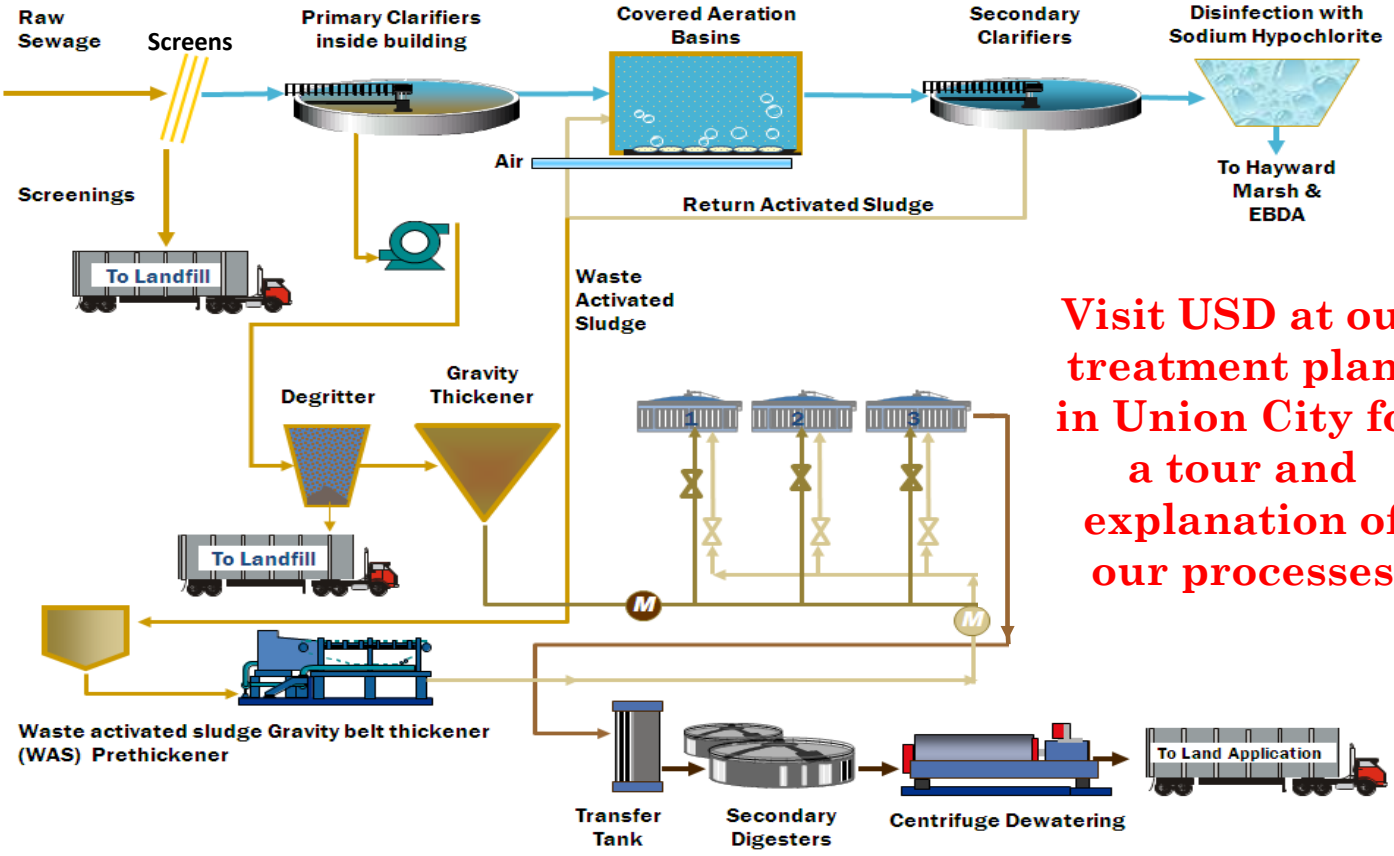
Local Information
Your garbage needs to go somewhere, otherwise we would be living in one big mess. Ask students who picks up their trash and find out what can be recycled

Household hazardous waste is collected at 41149 Boyce Road in Fremont or call (510) 624-5900. Up to 5 gallons of used motor oil can be dropped off at your local gas or service station. Find out what they will accept

The drinking water that serves all of Fremont, Newark and Union City is from the Alameda County Water District.



Union Sanitary District's Wastewater Treatment Process



Visit USD at our treatment plant in Union City for a tour and explanation of our processes

How do we clean wastewater in Newark, Fremont, and Union City ?

5-ESS3-1.

Each of the steps listed could be made into a card that a group of students will place in order after listening to all of the steps. Arrows would need to be drawn between the cards as well.

People need clean water to survive. We use water in our houses not only to drink, but to clean, flush, and rinse. All the water that comes into your house, through one set of pipes, must leave by another set of pipes. The water that leaves is called wastewater.

Treatment of wastewater (includes sewage, laundry water, and bathwater) goes to a wastewater treatment plant. In Fremont, Newark, and Union City it goes to the Union Sanitary District treatment plant in Union City, where it is cleaned and then **discharged** deep into the San Francisco Bay.

STEPS IN CLEANING WASTEWATER

- Wastewater is created in your home and travels to the treatment plant
- Large solids are removed at the screens in the treatment plant. These are washed and sent to landfill
- Solids are allowed to settle to the bottom of the clarifier.
- Solids are removed to the degritters and gravity thickeners
- Water is aerated to assist microorganisms in eating the waste as food
- Second settling of water removes smaller sediments and clarifies the water
- Water is **disinfected** with bleach or sodium hypochlorite to kill **pathogens**.
- Water is released into the bay.

STEPS IN MANAGING BIOSOLIDS

- Solids from the thickener go to the digesters
- Anaerobic bacteria consume solids creating natural gas and **biosolids**
- **Biosolids** are de-watered in the centrifuge
- **Biosolids** are sent to landfill or are land applied on farms

CO-GENERATION

The natural gas from our digesters is burned in a generator to produce heat and electricity which supplies up to 80% of our energy needs. The heat is also re-used in our digesters.

Union Sanitary District
5072 Benson Rd.
Union City CA 94587

Phone: 510-477-7500
Fax: 510-477-7501

We're on the web!
www.unionsanitary.ca.gov

To Schedule a Plant Tour contact
Doug Dattawalker on (510) 477 7637
Or email at dougd@unionsanitary.ca.gov

How Can You Help?

Storm Drain System

- Do not use the storm drain to dispose of liquid substances
- Wash your cars at a car wash
- Bring used oil, **pesticides** and **herbicides** to local household hazardous waste centers
- Use less toxic products on your lawn and gardens
- Pour dirty mop water into the sink or toilet
- Clean your driveway with a broom instead of a hose
- Ask your local City about stenciling storm drains with "No Dumping, Drains to Bay"

Sanitary Sewer System

- Do not use your toilet as a trash can
- Do not dispose of **pesticides** or **herbicides** in the sinks or toilets
- Follow directions on container labels for the safe disposal of household cleaning products, paints and medications

Where Does It Go?

Ask your students question 1-9 listed below. Put their answers into two columns on the board labeled (1) **Sanitary Sewer**, (2) **Storm Drain**.
In which pipeline system does the water go when …..

1. you brush your teeth? (*Sanitary Sewer*)
2. your parents wash your clothes? (*Sanitary Sewer*)
3. you wash the car in your driveway? (*Storm Drain*)
4. you wash the car at the carwash? (*Sanitary Sewer*)
5. you flush the toilet? (*Sanitary Sewer*)
6. your parents fertilize the lawn? (*Storm Drain*)
7. you paint and wash your brushes in the sink, (*Sanitary Sewer*); outside (*Storm Drain*)
8. you wash your pet inside? (*Sanitary Sewer*) outside? (*Storm Drain*)
9. you hose off your driveway? (*Storm Drain*)

Review with students the reasons not to put certain things down the sewer lines and the storm drains. Also review the purpose of these two systems in our daily lives.

Overview of Alvarado Wastewater Treatment Plant (top) ; Hayward Marsh (bottom)