

City of San Diego Public Utilities Department

TEACHER LESSON PLAN

Lesson 1: Wastewater

Purpose:

To introduce students to wastewater treatment in San Diego and to impress upon them that they are personally responsible for what goes down the drain.

Lesson in brief:

Students learn about wastewater and where it goes when it leaves our homes. They learn the basics processes of wastewater treatment.

Key concepts:

- Water is used to remove waste from our homes and communities through a wastewater system.
- Wastewater must be treated before it is return to the environment, to minimize any harmful effects.

Key words:

- Wastewater
- Influent
- Effluent
- Screens
- Grit chamber
- Primary Sedimentation / Clarifier Tanks
- Advance Primary Treatment
- Scum
- Sludge
- Biosolids
- Storm Water
- Storm Drains

Materials:

Chalkboard or mural size paper and markers

Time required:

One class period

Procedure:

1. Ask students what they have heard about San Diego Bay, Mission Bay or the Pacific Ocean.
(Some answers may be negative: it's polluted, it's disgusting, it's too dirty to swim in, etc. Let the students know that even though parts of San Diego water are polluted, there is still a lot of life in the bays and the ocean.)

2. Ask students to name some things that live in the bays and the Pacific Ocean. Create a mini-bay on one side of the board by having the students who name plants and animal come up and draw them. Seek diversity: fish, lobsters, plankton, birds, seals, seaweed and other plant live.
3. Ask for a volunteer artist and have him or her draw a toilet on the other side of the board. *(Expect laughter at this request).*
4. Ask the class why you had them draw the ocean on one side and a toilet on the other. What is the connection between a toilet and the Ocean? Someone may know, or may guess that their toilets eventually drain to the Ocean.
5. Explain that every time a toilet is flushed in one of the 16 cities and districts served by the Public Utilities Department the wastewater eventually ends up in the Pacific Ocean. Explain that wastewater = water + anything else you add to it. In the case of a toilet, water + human waste = wastewater. But human waste is not the only thing that is flushed down a toilet. Ask the students what else they have or know someone else has flushed down the toilet. List the answers on the board. *Examples are: toilet paper, hair, dead gold fish, food, cigarette butts, cleaning solutions, etc.*
6. Ask the students to name some of the other places in their homes where wastewater is produced and list the answers on the board. *Examples are:*
 - *Showers, where wastewater could be water + hair, soap, dirt, etc.;*
 - *Kitchen sinks, water + food, grease, detergent, etc.;*
 - *Washing machines, water + bleach, pieces of fabric, etc.*
7. Draw a pipe from the back of a toilet and explain that wherever wastewater is produced, there must be some sort of pipe so that it can leave the house. These small pipes leading out of buildings connect into bigger sewer pipes under the streets that are maintained by each city or town, which in turn feed into Public Utilities wastewater pipes, which eventually lead to the Pacific Ocean.
8. Have this last pipe stop just short of the ocean. Tell the students that the wastewater stops somewhere before it goes into the ocean. Ask the students if they know where it stops, or what is done to the wastewater before it is discharged into the ocean. Explain that the wastewater goes to San Diego's largest wastewater treatment plant in Point Loma to be "cleaned" before it is released into the ocean.
9. Before explaining the treatment process, ask the students where else wastewater may be produced *(Any place where water is used and disposed of is an acceptable answer. Examples: schools, hospitals, industries, and restaurants)*
10. Explain that wastewater is not only produced "inside" but also "outside". When it rains or a hose is used, this is also considered wastewater. This wastewater goes down the storm drains along the side of the road. This wastewater is also called "storm water." Draw a storm drain (Storm drains are the open holes along city street curbs usually marked by a duck stencil that reads "I live down stream."). Ask the class what things they think are found in storm water. *(Examples are: Water + rocks, cans, candy wrappers, car oil, soil fertilizer, money, pet waste, etc.)*

11. Explain that the storm drains DO NOT connect into sewer pipes. Whatever washes down the storm drains does not go to the treatment plant. Storm water travels in the storm drains to the some local body of water and eventually to the Pacific Ocean. Storm water does not get cleaned or treated.
12. Explain the wastewater treatment process using the wastewater treatment diagram (8 ½ x 11; horizontal layout) or print and photocopy the pages depicting each step (8 ½ x 11; horizontal layout). If you print out the individual steps, you may want to mix them up and ask the students if they can guess the correct order.

Advance Primary Treatment:

1. Influent Screens: The influent screens are between ¼ of an inch and 3 inches apart. The incoming wastewater (also known as influent) is allowed to flow through, but large objects such as rocks, sticks, cans and rags are stopped.
2. Grit chambers: This is where the flow of the wastewater is slowed, so that heavy, solid objects that were small enough to get through the influent screens such as pebbles, coffee grounds, jewelry, and coins can settle to the bottom. *(The solid material taken from the wastewater during these two processes is referred to as “grit and rags,” which are collected, hauled off-site and land-filled)*
3. Primary Treatment: In the primary sedimentation/clarifier tanks, the flow of the wastewater is again slowed to allow heavy organic solids to settle to the bottom and light, floatable objects *(expect laughter)* to side to the top. The material that settles to the bottom such as human waste and chemicals is referred to as “*sludge*,” and the material that rises to top, such as soaps, grease and oils, is referred to as “*scum*.”

The sludge, or biosolids, must be treated before it can be returned to the environment. Biosolids travel to the digesters where they are heated, allowing bacteria to attach or digest organic matter. The digested biosolids are then pumped to the Metro Biosolids Center where additional water is removed before they are land-filled or returned to the environment as fertilizer.

4. Advance Primary Treatment: At our Point Loma Wastewater Treatment Plant, ferric chloride and organic polymers are added during the primary sedimentation step to help waste particles bond together in large enough masses to settle out.

The treated wastewater, now called effluent, is ready to be returned to the environment through a 4.5 mile-long outfall pipe into the Pacific Ocean. The Point Loma Wastewater Treatment Plant cleans an average of 180 million gallons of wastewater per day.

13. Take the Quiz

QUIZ:

LESSON 1: WASTEWATER

Short Answer

Answer the following questions:

1. Where does San Diego discharge its treated wastewater? _____
2. Where is San Diego' largest wastewater treatment plant located? _____
3. Where does the sludge, or biosolids, go after treatment? _____
4. What is done with the treated biosolids after treatment? _____
5. Used motor oil, pesticides, paints and pet waste are considered what? _____
6. Is wastewater that flows into storm drains treated? _____
7. Where do storm drains discharge? _____

Multiple Choice

Circle the best answer:

1. Approximately how many gallons of wastewater per day are treated at the Point Loma Wastewater Treatment Plant?
A. 18 B. 180 million C. 18,000 D. 180,000
2. How long is the Point Loma Outfall where effluent is discharge into the Pacific Ocean?
A. 3 miles B. 4.5 miles C. 2 miles D. 6 miles
3. What is the treated wastewater called?
A. influent B. biosolids C. effluent D. storm water
4. What is the number of cities and districts that Public Utilities' wastewater system serves?
A. 16 B. 20 C. 10 D. 26

Matching

Match the words from Column A with the correct description in Column B

Column A

Column B

- | | |
|---------------------|---|
| 1. Biosolids | A. Place where rock, sticks and rags are screened out of the wastewater |
| 2. Effluent | B. A by-product of treated wastewater |
| 3. Grit Chamber | C. Cleaned wastewater |
| 4. Influent screens | D. A tank where mud and sand settle out of wastewater |