



## Water Recycling Lesson Plan

### **INTRODUCTION**

This lesson plan provides talking points for a teacher-led presentation and an interactive water filtration activity as an alternative field trip to West Basin Municipal Water District's Edward C. Little Water Recycling Facility. The presentation will cover the content on the provided PowerPoint and includes a live water filtration activity demonstration. This lesson is intended to support teachers conducting synchronous distance learning with their classrooms.

**Teachers:** If your students have any questions regarding the PowerPoint or activity, please contact Education Coordinator Janel Ancayan at [janela@westbasin.org](mailto:janela@westbasin.org) or 310-660-6253. Staff will be available during regular business hours (8A-5P) to support teachers.

**Age:** 3rd-12th grade (can be adapted to best serve different grade levels)

**Lesson Plan Length:** 1.5 hours

### **Materials:**

- PowerPoint (link provided)
- Edward C. Little Water Recycling Facility Video (link provided)
- Title-22 Recycled Water Video (link provided)
- *Optional* How Water Recycling Works (link provided)
- Water Filtration Activity Materials:
  - Multiple Cups
  - Dirty Water (tap water mixed with dirt)
  - Various Types of Cloth (preferably 3 types of cloth)
  - Spoon
  - Sponges
  - Funnel
  - Strainer
  - Rocks

### **Lesson Outline:**

1. [Lesson Set-Up](#)
2. [PowerPoint Presentation & Talking Points](#)
3. [Water Filtration Activity](#)
4. [Conclusion/Reflection](#)

### **Lesson Set-Up**

- a. Set-Up Water Filtration Activity and set aside
  - Make the dirty water by mixing tap water and dirt
  - Place dirty water into 3 cups and set aside
  - Gather other materials (feel free to work with what you have at home)
- b. Open the PowerPoint Presentation and Videos
  - i. Pre-load PowerPoint and test video capability prior to lesson

- i. PowerPoint

<https://www.dropbox.com/s/lnalyzt0dixybm/West%20Basin%27s%20Water%20Recycling%20PPT.pptx?dl=0>

- ii. Edward C. Little Water Recycling Facility Virtual Tour Video Link:  
<https://youtu.be/NGOP9r0gVvM>
  - iii. Title-22 / Irrigation Grade Video:  
<https://www.youtube.com/watch?v=UgNF8g-WmnM&t=2s>
  - iv. *Optional* Video: How Water Recycling Works  
<https://youtu.be/myBUTsO9ny8>
- ii. Test screen share capability
  - c. Send out PowerPoint and video for students to follow along in case of technical issues

### PowerPoint Presentation: Talking Points

#### a. *Slide 1: Introduction*

We will be discussing water resources and water recycling. West Basin Municipal Water District is your local wholesale water agency who provides water for 17 cities in the South Bay including <insert school city>. Water is a very important part of our life, and we use it every day to shower, wash our hands, and to drink. We will be learning how our water resources changed over time and what West Basin is doing to meet our water needs.

#### b. *Slide 2: Water Planet*

Here we see a breakdown of the water we have on Earth. Our planet is also known as the water planet or blue planet. Earth has approximately 75% of water to 25% of land. However, most of the water on our planet is our oceans (97%), otherwise known as salt water.

- Question: Can we drink all this salt water? (No, it's icky and can make our throat itchy!) That's correct. We only have a small amount of freshwater that all 7 billion people on the planet Earth can use...to cook, to shower, to drink, and to grow the food we eat.

The water we use in our homes and communities is freshwater, which makes up only 3% of our water supply. Out of that 3% only 1% is easily accessible—the rest is frozen! Even though Earth has plenty of water, our fresh water (the type of water we all actually use) is limited so we need to protect it.

**Note:** If desired, primary teachers can quickly review the **water cycle** (evaporation, condensation, precipitation).

#### c. *Slide 3: Groundwater*

Southern California's main source of water up to the mid-20<sup>th</sup> century was groundwater, the water that sinks into the ground and forms an underground lake called an aquifer. Our main source of groundwater is from the West Coast Groundwater Basin, which is where West Basin's name comes from. To get groundwater, we dig really deep underground to access the aquifer, then we can pump out that freshwater!

**Note:** Groundwater extracted from a well is sent to a Drinking Water Treatment Facility before it is sent to distribution pipelines, which then sends water to commercial and residential properties.

#### d. *Slide 4: Aqueducts*

Over time, more and more people moved into Southern California and the demand for water increased. Our groundwater supply was not enough to meet everyone's needs so

we began receiving water from other places, known as imported water. We get our water from the California Aqueduct (which starts in Northern California) and the Colorado River Aqueduct (which starts on the CA/AZ border). Aqueducts are man-made concrete rivers that bring water from far places to our communities.

- Question: What are some challenges that come with aqueducts? (climate change, maintenance, evaporation, etc.)

You're right—all of these challenges threaten how **reliable** our water supply is. If there is an earthquake, or if there isn't as much water one year due to climate change, we can't rely on all of the water that is imported through aqueducts. That's why West Basin recycles water at the Edward C. Little Water Recycling Facility to save that freshwater for human use. Every drop of water recycled is a drop of drinking water saved.

*e. Slide 5: Recycled Water!*

Recycling water takes dirty water and makes it clean again for uses like flushing toilets, commercial production, and watering grass! Even though we have groundwater and imported water, West Basin wants to secure a reliable source of water and reduce the need for imported water. We'll learn how West Basin recycles water.

*f. Slide 6: Step 1 – Get Water*

The first step is to find a source of water to recycle.

*g. Slide 7: California*

Here is an image of the state of California.

- Question: What can you observe about the difference between Northern and Southern California?

That's right! Southern California is brown, while Northern California is green, due to having more water through precipitation.

*h. Slide 8: Image of Los Angeles County*

Here is an image of LA County, which is home to four million people. All of those people use a lot of water every day to cook, clean, shower—everything! Does anyone know what the biggest city in LA County is?

*i. Slide 9: Image of the City of Los Angeles*

The biggest city in LA County is the City of Los Angeles. All one million people are drinking water, flushing the toilet, and showering. Once they're done using that water, it goes down the pipes as wastewater.

*j. Slide 10: Hyperion Water Reclamation Plant*

Wastewater used to be released into the oceans, which was very harmful to the environment. Now, the Hyperion Water Reclamation Plant (which receives the wastewater from the City of Los Angeles), cleans wastewater twice to environmental standards and then releases it into the ocean. The resulting water is cleaner than wastewater but is still not clean enough to re-use in irrigation or industrial processes.

*k. Slide 11: Bringing the water over*

The Hyperion Water Reclamation Plant is just a few miles away from West Basin's Edward C. Little Water Recycling Facility in El Segundo. West Basin purchases 40 million gallons of the treated wastewater and uses advanced technology to produce five types of water to specifically meet their customer's needs.

- l. Slide 12: Edward C. Little Water Recycling Facility*  
40 million gallons of treated wastewater is sent to the Edward C. Little Water Recycling Facility, where it is further cleaned to produce different types of recycled water. West Basin's facility is part of the only facility system in the nation that produces five different types of recycled water.
- m. Slide 13: Step 2 – Clean the Water Again*  
We'll be going over methods and uses for producing this water.  
**Note:** Teachers may adapt the following section to be more or less complex to serve the appropriate grade level.
- n. Slide 14: Title-22 Water*  
First, we will explore the production of Title-22 water, also known as irrigation water. If you have seen a purple sign like the one on the screen, it shows that irrigation water is being used. These signs help inform the community that recycled water is being used and to avoid drinking this water, which is not treated to drinking quality standards.

  - Video: <https://www.youtube.com/watch?v=UgNF8g-WmnM&t=2s>
- o. Slide 15: Purple – The Universal Color of Recycled Water!*  
Irrigation water is distributed in purple pipes to help differentiate between drinking water and irrigation water. Even though irrigation water is clean enough for outdoor use, it is not meant to drink.
- p. Slide 16: Goodyear Blimp*  
The Goodyear Blimp Base located in Carson uses recycled water to irrigate the grass around their landing strip.
- q. Slide 17: Dignity Health Sport Park*  
Dignity Health Sport Park, home of the Chargers and LA Galaxy, was the first sports facility to begin using recycled water to irrigate their fields.
- r. Slide 18: Cal State Dominguez Hills*  
Right next door, the California State University Dominguez Hills uses recycled water on their playing fields as well.
- s. Slide 19: Golf Course*  
The Lakes Golf Course, next door to the Edward C. Little Water Recycling Facility, uses recycled water to water their greens and fill some of their man-made lakes.
- t. Slide 20: Street Cleaning*  
Title-22 water is also used by street sweepers in the City of Inglewood. Street sweepers typically use drinking quality water, but this is an innovative use of recycled water!

u. *Slide 21: Toilets*

Did you know that we flush drinking quality water down the toilet every day? We can even use some of the water stored in the back of our toilets in cases of emergency! Some places, such as in this photo from the El Segundo Fire Department, use the Title-22 water to flush their toilets, helping us save drinking quality water.

v. *Slide 22: 3 Types of Oil Refinery Water (optional)*

West Basin produces three types of oil refinery water to support the needs of industries in the South Bay. The three types are:

1. Cooling tower water: Water that has been processed to remove ammonia for industrial cooling tower use.
2. Low-Pressure Boiler Water: Filtered by Membrane filtration and Reverse Osmosis membranes for use as low-pressure boiler feed water.
3. High-Pressure Boiler Water: Filtered by Membrane filtration and twice through Reverse Osmosis membranes for use as high- pressure boiler feed water.
  - Optional Video: How Water Recycling Works  
<https://youtu.be/myBUTsO9ny8>

w. *Slide 23: Groundwater Replenishment*

The final type of water produced is groundwater barrier. After years of withdrawing groundwater near the coast, salt water started to fill in the empty spaces underground and contaminating the fresh groundwater supply. This fifth type of water meets or exceeds drinking water standards and acts as a barrier to stop salt water from further contaminating the local groundwater supply.

x. *Edward C. Little Water Recycling Facility Video*

The following video will provide a tour of the facility and how West Basin produces five types of recycled water.

- Virtual Tour Video: <https://youtu.be/NGOP9r0gVvM>

y. *Slide 24: Conclusion*

West Basin Municipal Water District is committed to achieving water reliability and recycled water plays an important role in achieving that goal. Remember - “every drop of water recycled, is a drop of drinking water saved.” Title-22 water conserves drinking water by reducing its use in irrigation. The three cooling tower waters reduces the amount of drinking water used in industrial roles. The groundwater replenishment water helps protect our local groundwater supply.

Now that we’ve learned how West Basin recycles water on an industrial level, we’ll work together as scientists and engineers by filtering dirty water!

### **Water Filtration Activity**

- Preparation:
  - Place dirt water into three different cups.
  - Have all available supplies ready.

- Set-up all items so it is visible through your camera.
- Activity Overview:
  - Introduction:
    - Introduce students to the water filtration activity and available tools.
  - Live Demonstration
    - Students will send instruction to teacher via chat or by having students raise their hand via classroom platform.
    - You will try one approach for each student volunteer for each cup using the material. After each approach you will choose the clearest water and focus on that sample to make it cleaner.
    - The class will continue to suggest approaches until you all get significantly cleaner water.
    - After that you will combine steps and put the water through your homemade filter multiple time until you get clear water.
      - The goal is usually to come up with a filter using multiple layers of cloth, the rocks on top of the strainer, and pass water through the filter multiple times to get cleaner water. Replace or clean the cloth pieces when dirty.
  - Reflection
    - Have students identify successful and non-successful methods, and compare these methods to those used at the Edward C. Little Water Recycling Facility.
- Introduction
  - First, take a look at the items on the screen in front of you, what do you think we will be doing? Yes! You will be helping me filter our own “waste water.” For our “waste water” we are using regular tap water mixed with dirt. We have all these different materials and we will see what we can do to make cleaner water. \*List materials and show the materials on the screen\*
  - Who wants to raise their hand and tell me what materials they feel will work the best in this experiment? Why? (accept their answer and wait until after the experiment to ask again in the review) Okay, let me describe the guidelines to this experiment. You will then have a chance to ask me questions on anything that you’re unclear about.
  - Class, you will be telling me how to use these tools in front of me to filter the water. Remember all of the steps we saw in our presentation and video.
  - One of you will tell me the first step in filtering cup one. Once I do that step, we will move on to cup two, and eventually cup three. Once we have gone through the three cups we will pick the cleanest water and focus on getting the water crystal clear together.
- Activity
  - Who would like to start? Remember that we can use multiple items at the same time for each step... \*follow steps as directed by students\* Let’s see what we will do for the other cups. Repeat for cups two and three.

**Note:** Suggest the use of media (rocks) to filter water similar to the Title-22 filtration basins.

- Judging: Now let's see what cup has the cleanest water. It appears cup <insert cleanest cup> has the cleanest water. We will focus on this cup for the rest of our experiment and see how clean we can get it to be.
  - Let's see what happens if we do the same method but this time we will put our cleaner water through the filter again (Put the filter over a clean empty cup).
  - Is the water cleaner or dirtier?
    - Why? How can we make it better? (It should be cleaner)
- Note:** At this point address that you need to make sure your materials are clean. Replace or clean dirty items. West Basin's filters are regularly maintained.
- Repeat the process (feel free to update strategy as students suggest) until water is relatively clear. Clear water *is possible!* Thank all the students for helping produce "recycled water," just like West Basin's scientists and engineers.

- Activity Conclusion

- Questions:
  - Which items were not useful?...worked best?...and why?
  - See which processes work best and compare the procedures to the procedures and technologies of the facility.
  - Compare layering filter media to the anthracite coal they will see in the basins, compare sponges/basters.
- We are so used to getting crystal clear water in our homes that sometimes we take it for granted. Once the water is dirty, it takes many steps to get it clean again. Recycled water is an important resource because it allows us to conserve our drinking quality water. However, we can also do our part by not wasting any water. Once the water gets dirty and goes down the sewage pipes, it takes a lot of resources, time, and engineering to clean it again!

### Conclusion/Reflection

- Lead the discussion about what was learned during the activity
  - Potential Questions
    - Why is water so important?
    - Where do we get our water?
    - How does recycling water help us?
    - What are the benefits of water recycling?
    - What are some ways we can save water at our homes?