# WATER

About 71% of the earth is covered by water. The world's total water supply of about 332.5 million $mi^3$ of water, over 96 percent is saline. And, of the total freshwater, over 68 percent is locked up in ice and glaciers. Another 30 percent of freshwater is in the ground. Rivers are the source of most of the fresh surface water people use, but they only constitute about 300 $mi^3$ (1,250 $km^3$), about 1/10,000th of one percent of total water. [1] With the small percentage of drinkable fresh water, it's important to preserve water quality.

## STUDENT LEARNING OBJECTIVES

### WATER QUALITY

**1.** Understand the difference between storm drains and sanitary sewers.

*(Storm drains carry rainfall runoff and other drainage untreated to local streams, rivers and lakes. Sanitary sewers carry everything from the inside of houses and buildings to a wastewater treatment plant before it is discharged into local waterways.)*

**2.** Learn what can be done at home to protect water quality.

*(Scoop the poop (pet waste), "hit the target" (keep product off of hard surfaces to prevent runoff into storm drains) when using fertiliser and pesticides at home, use commercial car wash or wash car on grass, allow nothing but rain down the drain.)*

*3.* Identify and describe measures taken by golf courses to protect the quality of water on the course.

*(Buffer strips around water, covering drains and removing product from cart paths when applying dry*

[1] "The USGS Water Science School," 2014, < http://water.usgs.gov/edu/earthhowmuch.html> (accessed 10/21/2014).

*fertilizer, growing healthy turfgrass (avoids having to use extra products), no spray zones, bioswales for drainage, high tech spray equipment, timing and application methods, including use of weather data to determine ideal timing of products; equipment wash off stations and water-oil separators and water quality testing.)*

4. Take samples from a golf course water body and analyse the results. You may choose to do one or more of the following tests, depending on available time.

   *(Nutrient content in the water (nitrates, ammonia, and phosphorus), dissolved oxygen, and pH.)*

   Note: If your course uses reclaimed water for irrigation, share with the group that the quality of the reclaimed water often differs depending on the treatment plant that it comes from. Individual states normally set the standards for reclaimed water, so it may differ from state to state, in terms of quality, particularly sodium content.

   In many cases, sulphur and sulphur-containing fertilisers are applied to soils to bring down the pH. In other instances, superintendents will acidify the actual water using an acid injection or a sulphur burner which brings down the pH levels before the water is used for the irrigation. It's more expensive and requires equipment, but nevertheless, a lot of courses using reclaimed water do just that.

## Student Worksheet Questions

Review the worksheet questions with students at beginning of lab and at the end. It may also be printed out for students to complete as part of the excursion.

1. Water quality
    a. What is the difference between a storm drain and a sanitary sewer?
    b. How can we protect water quality at home?
    c. How do golf courses protect water quality?
    d. What did you learn from the water test process?

*Note:* The teacher may want to have additional material covered and will add to these questions. Take time to talk with the teacher in advance of the excursion.

## Excursion Requirements

- Safe location on the golf course to take class of students, adjacent to a lake or pond.
- LaMotte Pondwater Tour testing kit or similar water testing kit. See First Green website (http://thefirstgreen.org/-superintendent-resource-kit) for more information.
- Bucket of water collected from nearby pond or stream.

## Excursion Activity Outline

## Water Quality

Either host a walking tour of the golf course or just stand and point and discuss lake and pond management. You might discuss the use of buffer strips around water, covering drains and removing product from cart paths when applying dry fertilizer, growing healthy turfgrass (avoids having to use extra products), no spray zones, bioswales for drainage, high tech spray equipment, timing and application methods, including use of weather data to determine ideal timing of products; equipment wash off stations and water-oil separators and water quality testing.

If possible, locate your learning lab near a lake or pond. Beforehand, fill a bucket from the water source so students won't risk falling into the water to collect their samples.

### Ask the Students

1. What is the difference between storm drains and sanitary sewers?
   *Storm drains carry rainfall runoff and other drainage untreated to local streams, rivers and lakes. Sanitary sewers carry everything from the inside of houses and buildings to a wastewater treatment plant before it is discharged into local waterways.*

2. How can we protect water quality at home?
   *Scoop the poop (pet waste), use commercial car wash or wash car on grass, allow nothing but rain down the drain.*

3. What are some ways to test water quality?
   *Nutrient content in the water (nitrates, ammonia, and phosphorus), dissolved oxygen, temperature and pH.*

## Testing Water Quality of Retention Pond

### Steps

1. Ask students to pair up.
2. Give each pair of students an empty water sample baggie.
3. Instruct students to fill their bag with the pond/stream water to the fill line. (They should use the bucket of water that you've filled ahead of time.)
4. Have the students add the reagent according to your kit's instructions.

Note: If you do not have enough baggies or reagent, then select a student to help you with the experiment.

1. Allow the students to get their hands wet to create a lasting experience.
2. Analyse the results and discuss the outcomes and implications. Ask the students how your golf course might protect surface water from products used on the golf course.
3. The tour can end with a discussion of the use and value of lakes and ponds to the golf course and the surrounding community.

## Wrap Up

Tell the students that you are going to review what they have learned.  Ask them the questions that you posed at the beginning of the lesson plan and make sure they know the answers.  If you are using the worksheet, have the students complete the worksheet and read out the answers.


POSTER FROM

CITY OF BELLEVUE, WASHINGTON

# WORKSHEET FOR WATER QUALITY LEARNING LAB

**Date_____** **Golf Course _____**

**Student Name _____**

## Please answer the questions below while participating in the learning lab:

a. What is the difference between storm drain water and sanitary sewer water?

b. How can we protect water quality at home?

c. What are some ways to test water quality?

d. How can golf courses preserve water quality?