



**THE GLOBE PROGRAM**

A worldwide science and education program



Hydrosphere



Water Transparency

Transparency Tube Protocol





A. What is  
water  
transparency?

B. Why collect  
water  
transparency  
data?

C. How your  
measurements  
can help

D. How to  
collect your  
data.

E. Entering  
data on GLOBE  
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F. Understand  
the data.

G. Quiz  
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## Overview

This module:

- Reviews the selection of a GLOBE hydrology site
- Reviews the water sampling technique used in GLOBE hydrology protocols
- Guides the construction of the necessary instrument for this protocol
- Provides a step by step introduction of the protocol method

### Learning Objectives

*After completing this module, you will be able to:*

- Define water transparency
- Explain how environmental variables result in different transparency measurements
- Describe how the protocol procedures ensure the collection of accurate data
- Conduct transparency measurements in the field
- Upload data to the GLOBE portal
- Visualize data using GLOBE's Visualization System

Estimated time to complete this module: 1.5 hours



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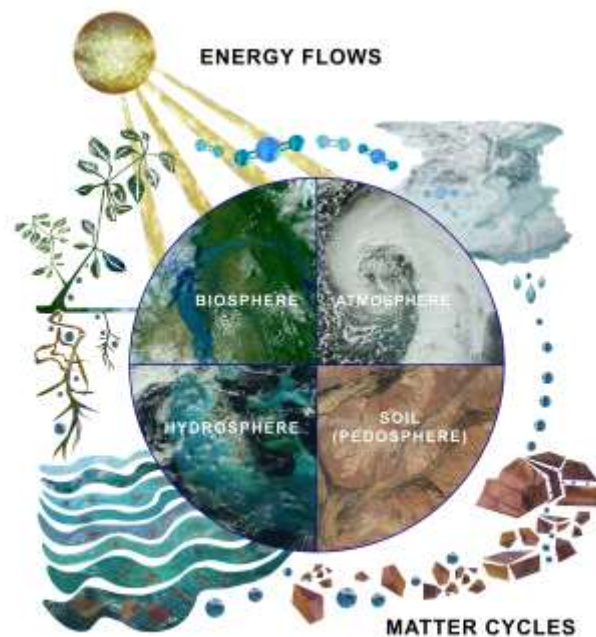
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## The Hydrosphere as part of the Earth System

The hydrosphere is the part of the Earth system that includes water, ice and water vapor. Water participates in many important natural chemical reactions and is a good solvent. Changing any part of the Earth system, such as the amount or type of vegetation in a region or from natural land cover to an impervious one, can affect the rest of the system. Rain and snow capture aerosols from the air. Acidic water slowly dissolves rocks, placing dissolved solids in water. Dissolved or suspended impurities determine water's chemical composition.

Current measurement programs in many areas of the world cover only a few water bodies a few times during the year. GLOBE Hydrosphere protocols will allow you to collect valuable data to help fill these gaps and improve our understanding of Earth's natural waters.



*The Earth System:  
Energy flows and matter cycles.*



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## Hydrosphere Protocols

What is the condition of Earth's many surface waters – the streams, rivers, lakes, and coastal waters? How do these conditions vary over the year? Are these conditions changing

from year to year? These are questions that are answered by the hydrosphere investigations in the GLOBE program.

**Water Transparency** is one the measurements used by GLOBE to describe the status of a water body. **Water Transparency** measures depth of light penetration into the water.

Water transparency depends on the amount of suspended particles. These can be organic, such as phytoplankton and algae, or inorganic, such as sediments, as well as other dissolved impurities such as organic or inorganic carbonates. These particles contribute to both the color and the transparency of the water.

### GLOBE Hydrosphere Measurements

Hydrosphere Study Site

Water Temperature

**Water Transparency**

Conductivity

pH

Mosquito Larvae

Alkalinity

Dissolved Oxygen

Salinity

Nitrates

Freshwater Macroinvertebrates



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# Water Transparency Describes Water Clarity

Water transparency is measured by determining the the depth of light penetration into the water column from the surface. **Algal blooms** such as this significantly reduce water transparency and contaminate onshore drinking water. The Operational Land Imager (OLI) on the Landsat 8 satellite captured this view of an algae bloom, Lake Erie, August 2014. [More](#)



Image: NASA Earth Observatory



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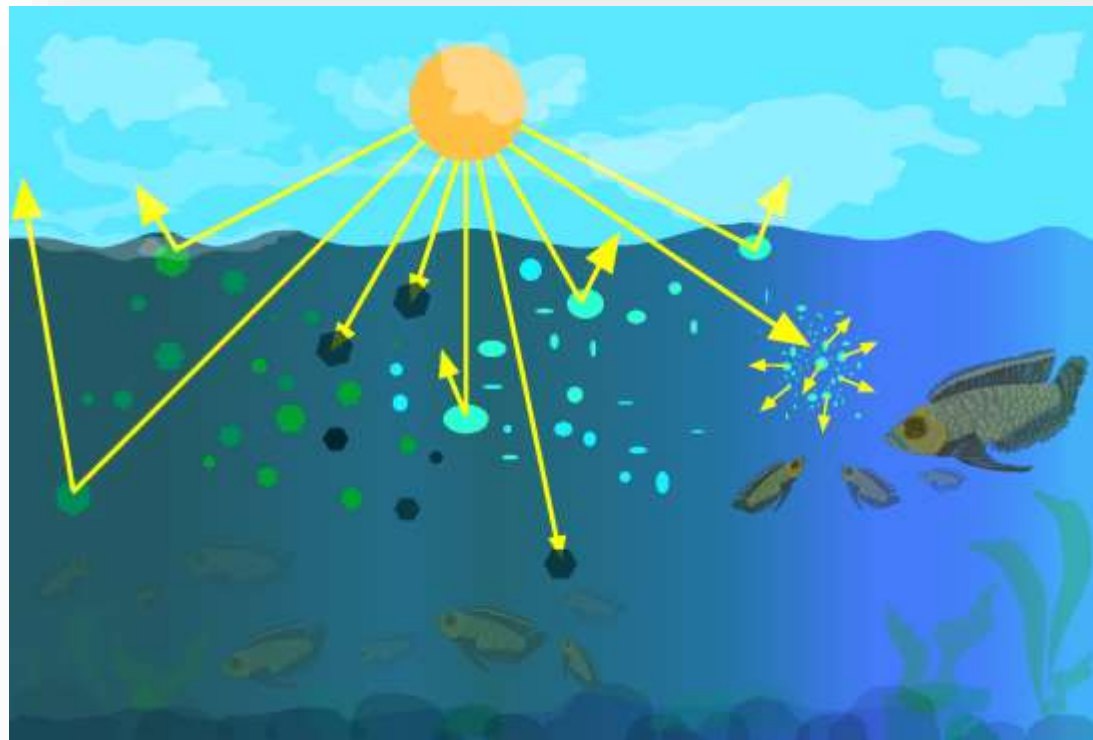
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# What is Water Transparency?



Particles in the water will reflect, absorb or scatter light, thus determining the depth at which light can no longer penetrate. This is called the **extinction depth**. The Water Transparency Protocol measures the light extinction depth of the water in your selected Hydrosphere Study Site.



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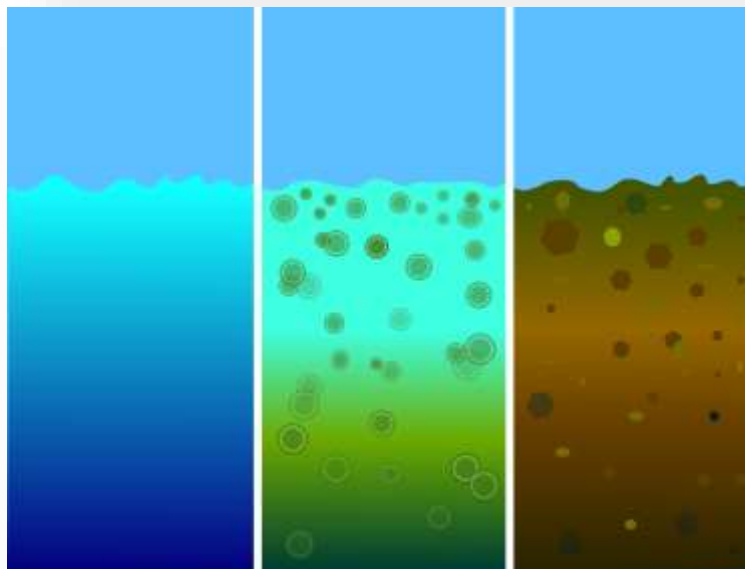
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## Particles in water absorb and scatter light

Suspended particles in water behave similarly to dust in the atmosphere. They reduce the depth to which light can penetrate. Sunlight provides the energy for photosynthesis (the process by which plants grow by taking up carbon, nitrogen, phosphorus and other nutrients, and releasing oxygen). How deeply light penetrates into a water body determines the depth to which aquatic plants can grow.

Transparency decreases with the presence of molecules and particles that can absorb or scatter light. Dark or black material absorb most wavelengths of light, whereas white or light materials reflect most wavelengths of light. The size of a particle is important as well. Small particles (diameters less than  $1\ \mu\text{m}$ ) can scatter light.





## Why Collect Water Transparency Data?

In most countries current measurement programs cover only a few water bodies a few times during the year. As a consequence, the archives of GLOBE hydrosphere data provides important information about water chemistry and water quality not found elsewhere.

By taking measurements over time in multiple locations, it is often possible to determine the times of year and the source of pollution, for instance, and if necessary, remediate the situation to improve water quality.

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## Summary: Water transparency changes in response to environmental factors

**Water transparency changes over time in response to environmental factors.**

Suspended particles such as phytoplankton, zooplankton, sediment, organic matter... are **optically active components** and their density and distribution varies over time. Erosion and run off during a storm is one source of sediment particles. The influx of nutrients such as phosphorus into a water body can cause an algal bloom, greatly increasing the density of these organisms.

- **The more suspended particles, the less transparency**
- An increase in suspended particles in a water body will decrease transparency, and light will be unable to penetrate into deeper water.
- **Light energy is needed by plants to conduct photosynthesis**
- Less light penetration into the water will affect the health of organisms living in the water body.
- **Water transparency affects water quality**
- Suspended particulates impact water quality, both for human consumption and for use by aquatic organisms



## How Your Measurements Can Help-1

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Credit:  
NASA Earth  
Observatory

Water transparency and color can be observed in satellite imagery. In May 2015, the east coast of Australia was hit by a severe storm and deadly flooding, dropping more than 360 millimeters (14 inches) of rain within about three hours in southeast Queensland, Australia. This image of the Brisbane River entering Moreton Bay was acquired on May 3, 2015 by the Operational Land Imager on Landsat 8.



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## How Your Measurements Can Help-2



Credit:  
NASA Earth  
Observatory

As a result of the rainfall, flash flooding caused distinct river plumes to form along the coastline. Flood waters usually contain elevated levels of sediment and colored dissolved organic matter (CDOM). Sediment tends to scatter red light, and CDOM absorbs blue light. As a result, a brown color is visible where the Brisbane River mouth where these two optical phenomena work in concert. Further from the mouth, the coarser sediments tend to settle to the bottom but the CDOM is still observed in the water column absorbing blue light. What is coloring the yellow-green patches in the water? Scientists believe it is CDOM, but **ground verification is needed to be sure.** [More](#)



Let's do a quick review before moving onto data collection!  
**Question 1**

**Which of the following suspended particles can influence the depth of light penetration in the water column?**

- A. Organic, like algae
- B. Inorganic, like clay or silt
- C. Dissolved impurities, such as carbonates
- D. All of the above

**What is the answer?**

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Let's do a quick review before moving onto data collection!  
Answer to Question 1

**Which of the following suspended particles can influence the depth of light penetration in the water column?**

- A. Organic, like algae
- B. Inorganic, like clay or silt
- C. Dissolved impurities, such as carbonates
- D. **All of the above 😊 Correct!**

**Were you correct?**

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## Let's do a quick review before moving onto data collection! Question 2

### Why are GLOBE water transparency data important?

- A. Because most water bodies in the world are not sampled by other scientists, the data provides important information that would not otherwise be collected
- B. It provides an opportunity for students to collect data that they can use in their own environmental investigations
- C. It allows students to monitor water quality in their community
- D. Transparency data can be used as ground validation of data collected by satellites.
- E. All of the above
- F. A and B only

**What is the answer?**

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## Let's do a quick review before moving onto data collection! Answer to Question 2

### Why are GLOBE water transparency data important?

- A. Because most water bodies in the world are not sampled by other scientists, the data provides important information that would not otherwise be collected
- B. It provides an opportunity for students to collect data that they can use in their own environmental investigations
- C. It allows students to monitor water quality in their community
- D. Transparency data can be used as ground validation of data collected by satellites.
- E. **All of the above 😊 Correct!**
- F. A and B only

**Were you correct? Now let's look at the GLOBE Protocol for measuring water transparency using a Transparency Tube (Turbidity Tube) .**



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## Protocol at a Glance

When	Weekly, if possible
Where	Hydrosphere Study Site
Time Needed	10 minutes
Prerequisites	Described Hydrosphere Study Site
Key Instrument	Transparency (Turbidity) Tube
Skill Level	Beginner
References	GLOBE Cloud Chart Water Transparency Using a Secchi Disk Field Guide



# How to Collect Your Data

## Simultaneous or Prior Investigations Required to do Water Transparency Measurements

You will need to define your **Hydrosphere Study Site**. A **Hydrosphere Study Site** can be any surface water site that can be safely visited, although natural waters are preferred.

- Sites, in order of preference, may include:
- Streams or rivers
- Lakes, reservoirs, bays or ocean
- Pond
- Irrigation ditch or other water body, if those above are not available

**The Hydrosphere Investigation Data Sheet** is used to record all the hydrosphere measurements, including Water Transparency. You will also want to map your Hydrosphere Site at some point.

To define your study site you will need these documents:

- [Selecting and Documenting your Hydrosphere Study Site](#)
- [Hydrosphere Investigation Data Sheet](#)
- [Mapping your Hydrosphere Study Site Field Guide](#)

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## Determine Which is Appropriate for Your Water Body: Secchi Disk or Transparency Tube?



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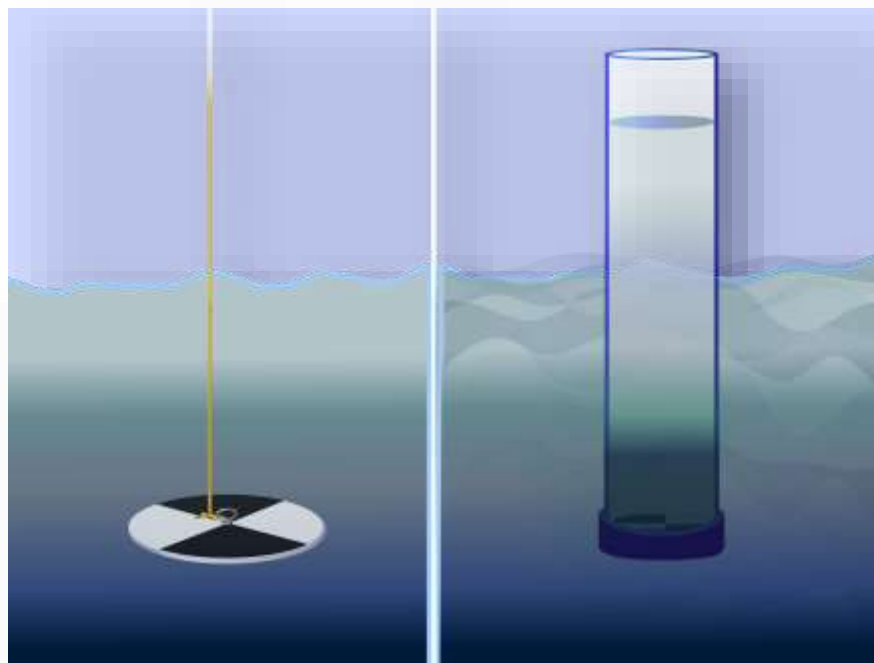
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## How to Collect Your Data: Select Appropriate Instrument

First, determine if your study site has **deep, still water or shallow and/or flowing water**. If the water is deep and still, you will use a **Secchi Disk** for your water transparency measurements. If the water is shallow or flowing, you will use a **Transparency Tube** (also called a Turbidity Tube). If you will be using the Secchi Disk, use instructions in the the **Water Transparency Secchi Disk Field Guide**.



Secchi Disk used with deep and still water

Transparency Tube used with shallow or Flowing water

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## Transparency Tube Protocol Overview

- Assemble field equipment
- Collect site data
- Conduct cloud type and cloud cover measurements
- In the Field: Take the measurements using a transparency tube
- Repeat 3 times to ensure accuracy and precision
- Verify that the data from the three measurements are within **10 cm** of the mean, (but do not average your data for reporting)
- Report your data to the GLOBE website



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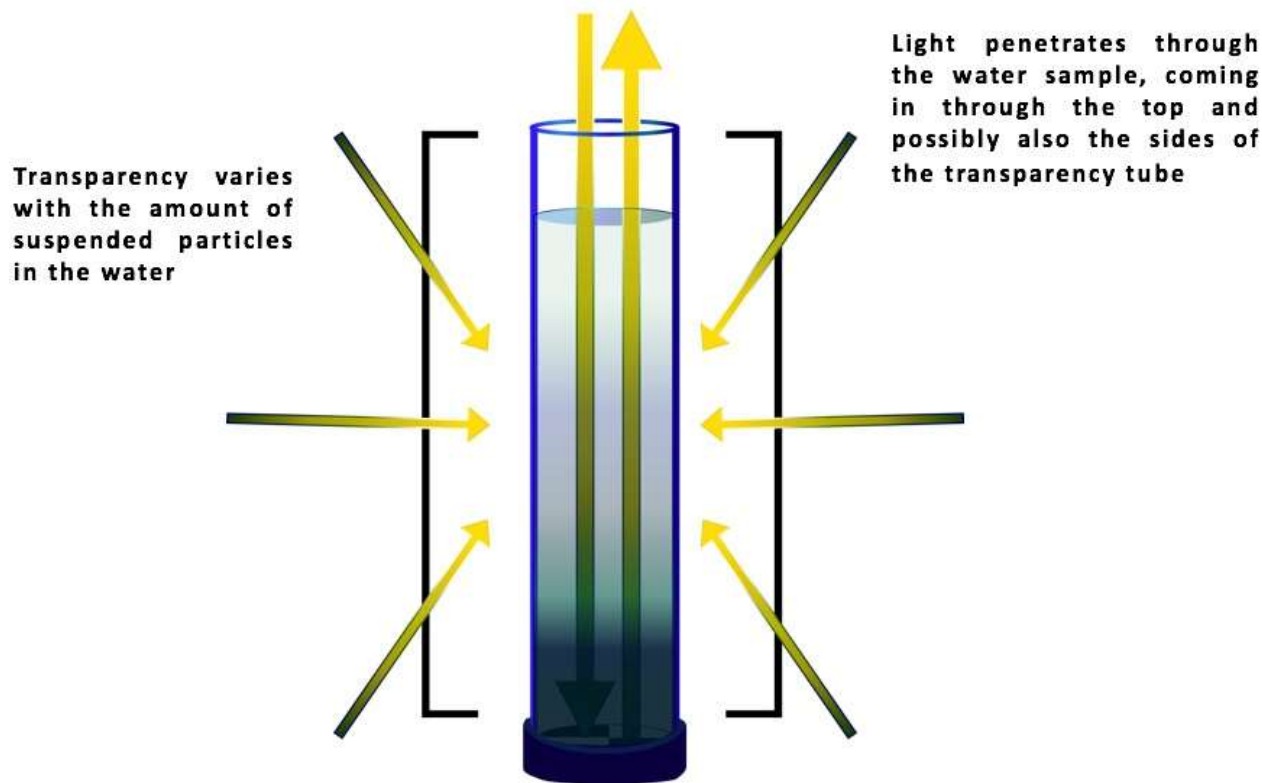
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## Using the Transparency Tube

The transparency tube measures light penetration through surface waters



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## Time Requirements

**Time to complete protocol:** About 10 minutes

**Frequency:** Ideally, weekly measurements at the same sampling site

**Ease of Protocol:** Beginner Level





## Assemble Field Equipment



Bucket and rope



Latex or Nitrile gloves



Permanent marker or pencil



Meter stick



Transparency  
Tube:  
(Instructions to  
build homemade  
transparency  
tube next slide)

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## Assemble Documents Needed in the Field

Before measuring water transparency cloud type and cover must be measured for the site. Measurement of water transparency must be done in the shade to avoid sun glare and differences in visibility.

### What You Need:

- [Transparency Tube Transparency Protocol](#)
- [Collecting Water Sample in a Bucket](#)
- [Hydrosphere Investigation Data Sheet](#)
- [Cloud Type and Cover Protocol Field Guide](#)
- [Contrail Type and Cover Protocol Field Guide](#)
- [Globe Cloud Chart](#)





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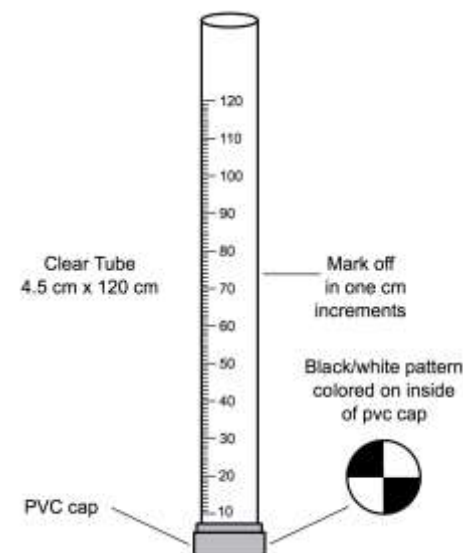
## Instrument Construction Instructions for Making a Transparency Tube

### Materials:

- \*Clear tube approximately 4.5 cm x 120 cm
- PVC cap (to fit snugly over one end of the tube)
- Permanent black marker
- Meter stick or meter tape

### Construction:

1. On the bottom of the inside of the PVC cap, draw a Secchi disk pattern (alternating black and white quadrants) with the black permanent marker.
2. Put the PVC cap over one end of the tube. Cap should fit tightly so water cannot leak out.
3. Use the marker and meter stick to draw a scale on the side of the tube. The bottom of the inside of the PVC cap where the Secchi disk pattern is drawn is 0 cm. Mark every cm up from that point.
4. A shutoff valve can be installed near the bottom of the tube to allow water to escape in a controlled manner; this would resemble commercially-available transparency tubes. You can also drill a small hole near the bottom that you can plug with your finger when you are making measurements.



*\*Many hardware stores carry long tubes for protecting fluorescent light bulbs. These are inexpensive and make excellent transparency tubes. If these are not available, any long, clear plastic tube may be used: the length is more important than the diameter.*



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## Start your Fieldwork and Lab Work with Safety Steps

Safety is important when conducting the Hydrosphere protocols. While you will need to use your judgment in selecting only hydrosphere study sites that are safe to access and sample, additional precautions are needed:

- Students should wear protective gloves and goggles when handling water samples and chemicals to avoid splashing on exposed areas.
- When doing GLOBE Hydrosphere Protocols, it is important to protect students from exposure to biting insects, including mosquitoes. Ask your students to wear clothes that cover the body so there is little bite area exposed. It is also advisable to apply insect repellent if you are sampling during the mosquito breeding season.



**SAFETY** be sure students wear gloves and goggles during your investigations





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## In the Field: Collect Hydrosphere Investigation Site Data

Fill out top portion of **Hydrosphere Investigation Data Sheet**

### Hydrosphere Investigation Data Sheet

School name: \_\_\_\_\_ Class or group name: \_\_\_\_\_

Name(s) of Student(s) collecting data: \_\_\_\_\_

**Measurement Time: \***

Year: \_\_\_\_\_ Month: \_\_\_\_\_ Day: \_\_\_\_\_ Time: \_\_\_\_:\_\_\_\_ (UT) Time: \_\_\_\_:\_\_\_\_ (Local)

Name of Site : \_\_\_\_\_

**Water State: (check one) \***

☐ Normal ☐ Flooded ☐ Dry ☐ Frozen ☐ Unreachable

**Note:** If Normal is selected, continue below; all other selections stop here



**SAFETY** be sure to wear gloves and goggles during your investigations





## Describe the sky conditions and clouds

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**Sky Conditions (Check one):**

- ☐ Clear (no Clouds Visible)
- ☐ Clouds Visible (1% to 100% Covered by Clouds or Contrails)
- ☐ Obscured (More than 25% of the Sky is not Visible)

**Note:** selecting **Obscured** will prevent data entry on clouds and contrails; therefore skip the cloud type and cover and the contrail type and cover sections and proceed to the Obscured section. If clouds and contrails are visible in non-obscured areas of the sky, these data can be entered in the Metadata field.

**If Clouds are Visible select all Cloud Types Seen**

High (in the sky): (Check all types seen)	 <input type="checkbox"/> Cirrus	 <input type="checkbox"/> Cirrocumulus	 <input type="checkbox"/> Cirrostratus
Middle (of the sky): (Check all types seen)	 <input type="checkbox"/> Altostratus	 <input type="checkbox"/> Altocumulus	
Low (in the sky): (Check all types seen)	 <input type="checkbox"/> Stratus	 <input type="checkbox"/> Stratocumulus	 <input type="checkbox"/> Cumulus





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## In the Field: Collect Your Water Sample

3. Put on protective gloves

4. Collect a surface water sample as follows:

- Rinse bucket with water from the site to avoid contamination. Do not use distilled water to clean the bucket.
- Hold tightly onto the rope.
- If your sampling site is a stream, throw the bucket out to a well-mixed area (a riffle), a little distance from the shore. Ideally, the water should be flowing at least slightly. If you are sampling from a lake, bay, or the ocean, stand on the shore and throw the bucket as far out as possible to collect your sample
- If the bucket floats, jostle the rope until some water enters the bucket.
- You should always take a sample from the top surface water. Be careful not to let the bucket sink to the bottom or stir up bottom sediment.
- Allow the bucket to fill about 2/3 to 3/4 full and pull it back in with the rope.



Be sure to rinse bucket with sample water



## Filling the Transparency Tube with water sample

5. Stand with your back to the sun, so that the transparency tube is shaded.

6. Pour sample water slowly into the tube using a cup. Look straight down into the tube with your eye close to its opening.

Stop adding water when you can't see the Secchi pattern at tube's bottom.



**Measurement of water transparency must be done in the shade to avoid sun glare and differences in visibility.**

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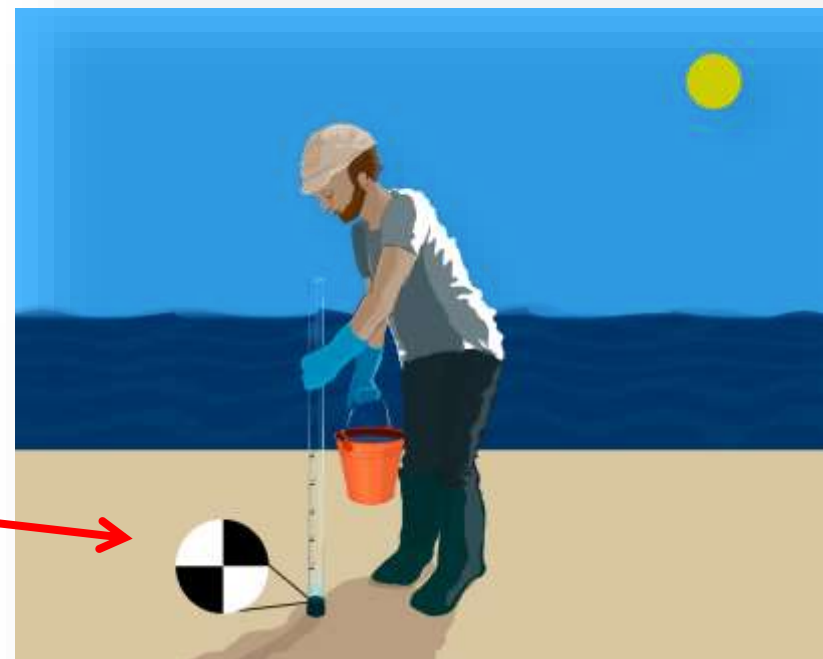
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## Collect your Data Using the Transparency Tube

7. Rotate the tube slowly as you look to ensure that you can't see the Secchi pattern.

The Secchi pattern at the bottom of the tube should be completely unrecognizable when you look through the tube.



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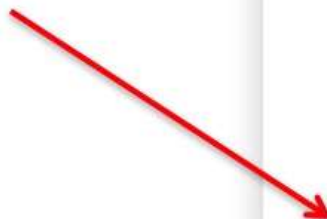
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Repeat measurement 3 X and **you are done!**

**Repeat the Secchi disk  
measurement for a  
total of 3x and record  
your data**



Hydrosphere Investigation Data Sheet - Page 3

### Transparency

Enter data below, depending on whether you are using the Secchi Disk or the Transparency Tube method.

#### Secchi Disk

##### Secchi Disk Test 1:

Distance from observer to:

to water surface \_\_\_\_ m

where disk disappears \_\_\_\_ m    where disk reappears \_\_\_\_ m

OR

☐ Secchi Disk reaches the bottom and does not disappear.

to water surface \_\_\_\_ m    depth to the bottom of the water site \_\_\_\_

##### Secchi Disk Test 2:

Distance from observer to:

to water surface \_\_\_\_ m

where disk disappears \_\_\_\_ m    where disk reappears \_\_\_\_ m

OR

☐ Secchi Disk reaches the bottom and does not disappear.

to water surface \_\_\_\_ m    depth to the bottom of the water site \_\_\_\_

##### Secchi Disk Test 3:

Distance from observer to:

to water surface \_\_\_\_ m

where disk disappears \_\_\_\_ m    where disk reappears \_\_\_\_ m

OR

☐ Secchi Disk reaches the bottom and does not disappear.

to water surface \_\_\_\_ m    depth to the bottom of the water site \_\_\_\_

#### Transparency Tube

Transparency Tube Test 1: \_\_\_\_ cm

☐ Greater than depth of Transparency Tube

Transparency Tube Test 2: \_\_\_\_ cm

☐ Greater than depth of Transparency Tube

Transparency Tube Test 3: \_\_\_\_ cm

☐ Greater than depth of Transparency Tube

Comments: \_\_\_\_\_

\_\_\_\_\_



A. What is water transparency?

B. Why collect water transparency data?

C. How your measurements can help

D. How to collect your data.

E. Entering data on GLOBE Website.

F. Understand the data.

G. Quiz yourself

H. Additional resources

Let's do a quick review before moving to GLOBE data reporting and visualization! Question 3

**If you have deep, still water, what is the water transparency method of preference in GLOBE Hydrosphere investigations?**

- A. Secchi Disk Method
- B. Transparency Tube (also called turbidity tube) method

**What is the answer?**



A. What is water transparency?

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Let's do a quick review before moving to GLOBE data reporting and visualization! Answer to Question 3

**If you have deep, still water, what is the water transparency method of preference in GLOBE Hydrosphere investigations?**

A. Secchi Disk Method 😊 **Correct!**

B. Transparency Tube (also called turbidity tube) method

**Were you correct?**



A. What is water transparency?

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C. How your measurements can help

**D. How to collect your data.**

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Let's do a quick review before moving to GLOBE data reporting and visualization! Question 4

**How many replicate measurements should you make, in order that ensure your data are reliable?**

- A. Only once- since it is a very straightforward protocol and since there is no chemical measurements, there is less chance of human error.
- B. Three times, report the average of the three measurements
- C. Three times, report all three measurements

**What is the answer?**



A. What is  
water  
transparency?

B. Why collect  
water  
transparency  
data?

C. How your  
measurements  
can help

**D. How to  
collect your  
data.**

E. Entering  
data on GLOBE  
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Let's do a quick review before moving to GLOBE data reporting and visualization! Answer to Question 4

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- C. Three times, report all three measurements 😊 Correct!**

**Were you correct?**



A. What is water transparency?

B. Why collect water transparency data?

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**D. How to collect your data.**

E. Entering data on GLOBE Website.

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G. Quiz yourself

H. Additional resources

Let's do a quick review before moving to GLOBE data reporting and visualization! Question 5

**When scientists take water transparency measurements, they also describe other conditions that may affect their measurements. What are they?**

- A. Lithosphere-the local rock types
- B. Atmosphere-the cloud conditions
- C. Biosphere-the plants found by the side of the water

**What is the answer?**



A. What is water transparency?

B. Why collect water transparency data?

C. How your measurements can help

D. How to collect your data.

E. Entering data on GLOBE Website.

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G. Quiz yourself

H. Additional resources

Let's do a quick review before moving to GLOBE data reporting and visualization! Answer to Question 5

**When scientists take water transparency measurements, they also describe other conditions that may affect their measurements. What are they?**

- A. Lithosphere-the local rock types
- B. **Atmosphere-the cloud conditions 😊 Correct!**
- C. Biosphere-the plants found by the side of the water

**Were you correct?**



A. What is water transparency?

B. Why collect water transparency data?

C. How your measurements can help

**D. How to collect your data.**

E. Entering data on GLOBE Website.

F. Understand the data.

G. Quiz yourself

H. Additional resources

Let's do a quick review before moving to GLOBE data reporting and visualization! Question 6

**What safety precautions should you take in the field with your students?**

- A. Students should wear protective gloves and eyewear
- B. Protection from biting insects, such as wearing clothes that limit skin exposure and using insect repellent
- C. For this protocol, it is not necessary, because the Water Transparency methods do not use dangerous chemicals
- D. A and B

**What is the answer?**



A. What is water transparency?

B. Why collect water transparency data?

C. How your measurements can help

**D. How to collect your data.**

E. Entering data on GLOBE Website.

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Let's do a quick review before moving to GLOBE data reporting and visualization! Answer to Question 6

**What safety precautions should you take in the field with your students?**

- A. Students should wear protective gloves and eyewear
- B. Protection from biting insects, such as wearing clothes that limit skin exposure and using insect repellent
- C. For this protocol, it is not necessary, because the Water Transparency methods do not use dangerous chemicals
- D. A and B 😊 Correct!**

**Were you correct? Now let's review the procedure for reporting and visualizing GLOBE data.**



# Submitting your data to GLOBE

- **Live Data Entry**: Upload your data to the official
- **Email Data Entry**: Send data in the body of your email (not as an attachment) to **[DATA@GLOBE.GOV](mailto:DATA@GLOBE.GOV)**
- **Mobile Data App**: Download the GLOBE Science Data Entry app to your mobile device and select the right option.
- **For Android** via **[Google Play](#)**
- **For IOS** via the **[App Store](#)**
- 





# Entering your data via Live Data Entry or Data Entry Mobile App- Step 1

A. What is water transparency?

B. Why collect water transparency data?

C. How your measurements can help

D. How to collect your data.

E. Entering data on GLOBE Website.

F. Understand the data.

G. Quiz yourself

H. Additional resources

Identify your  
Sampling site

Select  
“Integrated Hydrology”  
and “New observation”

Welcome to the GLOBE data entry site. ✕

### My Bookmarks

You have not bookmarked any investigations yet. Expand the organizations and click the stars next to the investigations to create a bookmark.

### My Organizations and Sites

— [University of Nebraska-Lincoln GLOBE v-School](#) 📍 Add site

+ [Lefthand Creek](#)  
Latitude 40, Longitude -105, Elevation 1600m  
[✎ Edit site](#) | [✕ Delete site](#)

### Hydrology

**Freshwater Macroinvertebrates** ★  
[New observation](#) [Past observations](#)

**Integrated Hydrology** ★  
[New observation](#) [Past observations](#)

**Mosquitoes** ★  
[New observation](#) [Past observations](#)



# Entering your data via Live Data Entry or Data Entry Mobile App- Step 2

A. What is water transparency?

B. Why collect water transparency data?

C. How your measurements can help

D. How to collect your data.

E. Entering data on GLOBE Website.

F. Understand the data.

G. Quiz yourself

H. Additional resources

1. Select water body state

2. Select protocol

⚠ Be sure to enter data as **Transparency Tube**

4. Click to send data

3. Enter each measurement and click "add"

**You are done! Want to check who else has submitted transparency data using the GLOBE Visualization System?**



A. What is water transparency?

B. Why collect water transparency data?

C. How your measurements can help

D. How to collect your data.

E. Entering data on GLOBE Website.

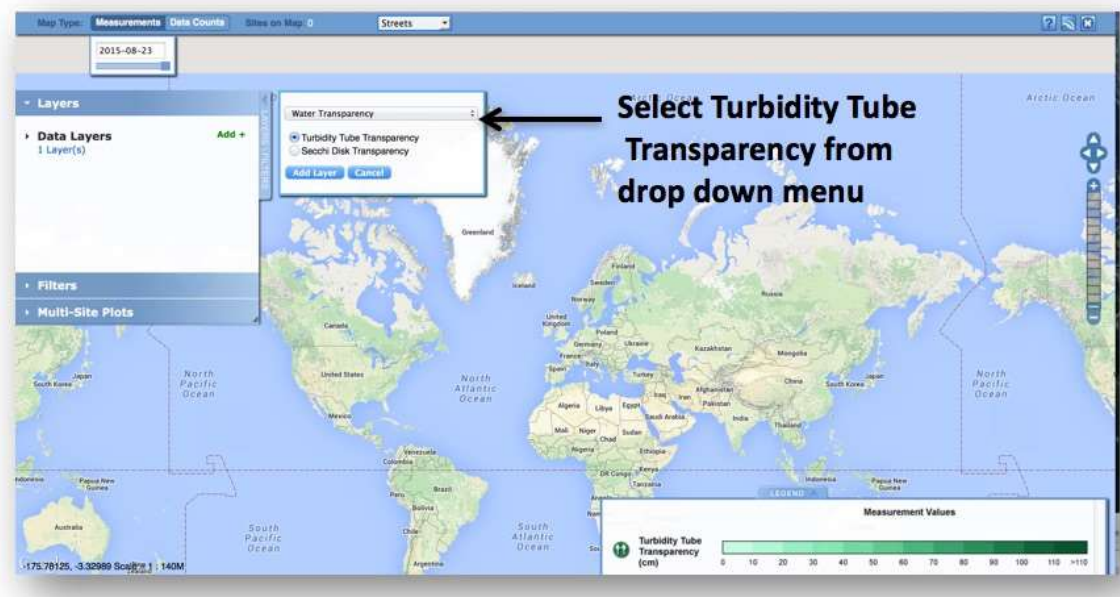
F. Understand the data.

G. Quiz yourself

H. Additional resources

## Visualize and Retrieve Data- Step 1

GLOBE provides the ability to view and interact with data measured across the world. Select GLOBE's [Visualization](#) System to map, graph, filter and export transparency tube data that have been measured across GLOBE protocols since 1995. Note that the terms Transparency Tube and Turbidity Tube are interchangeable.



[Link](#) to step-by-step tutorial on using the GLOBE Data Visualization System



## Visualize and Retrieve Data- Step 2

Select the date for which you need Secchi Disk Transparency data, add layer and you can see where data is available



Banner: Water Transparency using a  
Transparency Tube

Locations where  
Turbidity Tube  
Transparency data is  
available for the week  
you selected

A. What is  
water  
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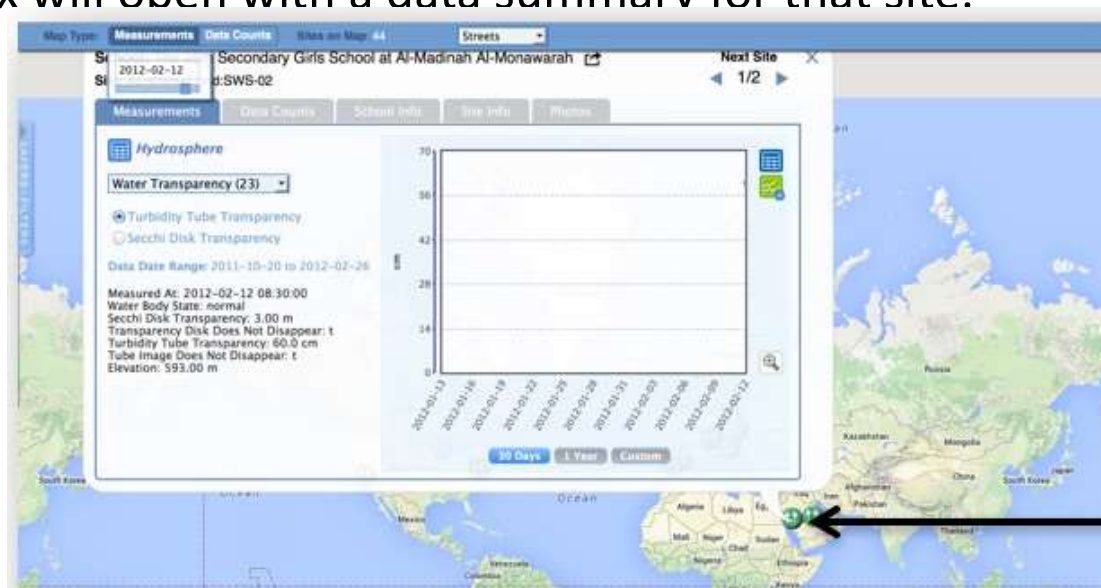
F. Understand the data.

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## Visualize and Retrieve Data- Step 3

Select the sampling site for which you need Transparency data, and a box will open with a data summary for that site.



Clicking on a location will open to a map note providing Turbidity Tube Transparency data for that location and time. Follow instructions in the tutorial to download data as a .csv file for analysis.



## Review questions to help you prepare to measure Water Transparency at your Hydrosphere Study Site

1. What does water transparency measure?
2. What kind of suspended particles are found in water bodies?
3. The absolute depth at which light can penetrate through a water column is called \_\_\_\_\_?
4. The more suspended particles, the (more/less) transparency.
5. When water is still and deep, the appropriate transparency instrument is (Secchi disk/Transparency Tube).
6. Your three replicate measurements should be within \_\_\_\_\_cm of the mean.
7. Why do you need to take your transparency measurement in the shade?
8. Why is it necessary to describe cloud cover when taking transparency measurements?
9. What are some reasons water transparency measurements may change over the course of a year?
10. What safety precautions should you take prior to conducting any of GLOBE's hydrosphere protocols?

A. What is water transparency?

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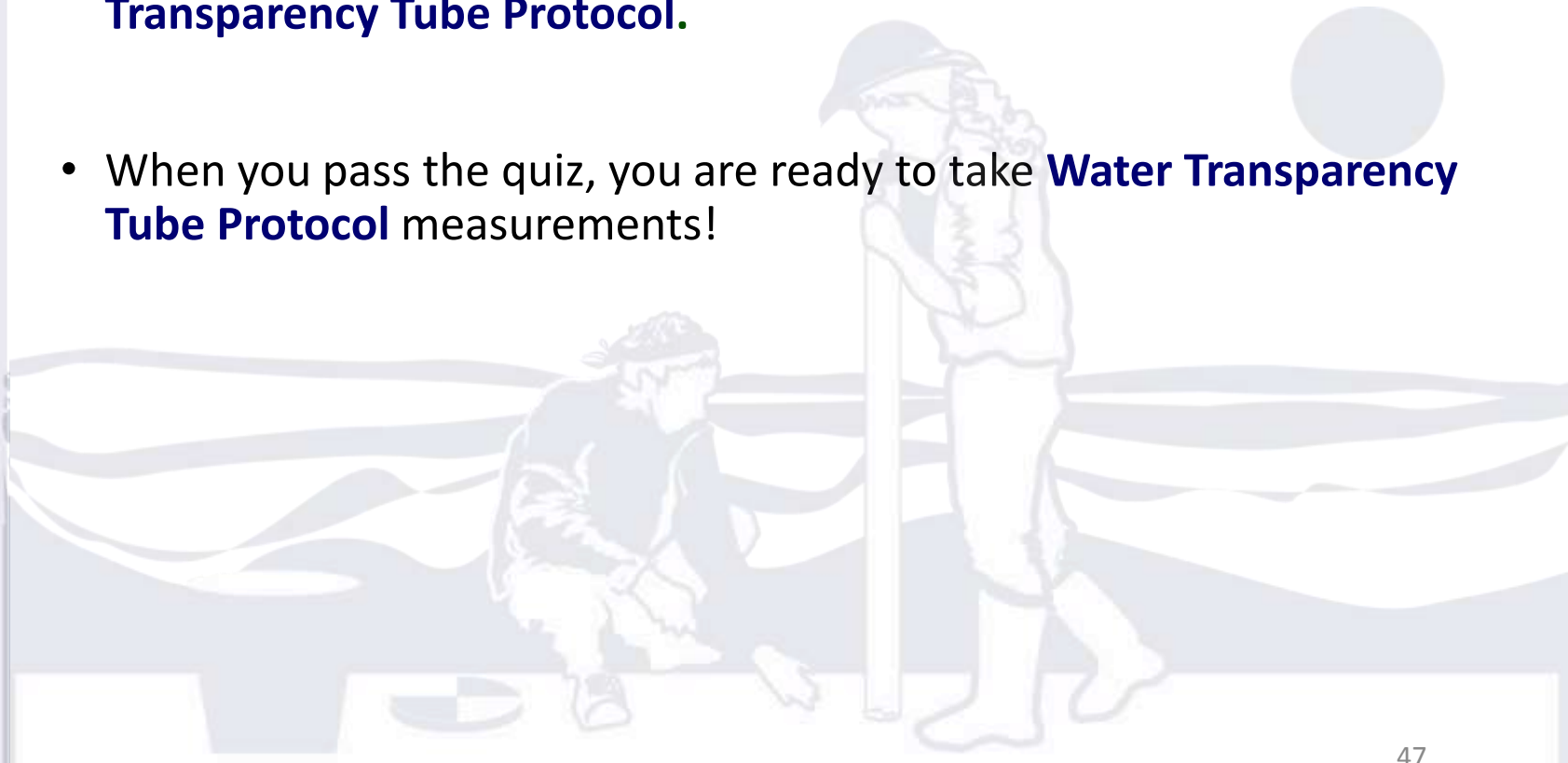
G. Quiz yourself

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## Are you ready to take your quiz?

- You have now completed the slide stack. If you are ready to take the quiz, sign on and take the quiz corresponding to **Water Transparency Transparency Tube Protocol**.
- When you pass the quiz, you are ready to take **Water Transparency Tube Protocol** measurements!



A. What is water transparency?

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## Frequently Asked Questions- FAQs

**When comparing data between sites, do you need to make an adjustment for data taken at the water surface compared to data taken from a bridge or dock?**

This distance is not used to adjust the Secchi disk data. However, reporting the distance between the observer and the water helps in data interpretation.

**My students are using a pond for our hydrosphere measurements. They go out in a boat and use a Secchi disk for the transparency. We are not sure of the two measurements we are asked to give. They measure the line at the surface of the water to the top of the disk when it disappears and reappears. What is the other measurement?**

For the other measurement, distance from where you read the line to the water surface, you should enter zero. Some schools will make Secchi disk readings from a bridge or pier, and report the depth measured using a reference level that is not the water surface, but some distance above the water surface. So they need to also enter the distance from the pier to the water. That way we have all of the raw data in the database.



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## Connections to the Classroom: Suggested Sequence of Learning Activities from the [GLOBE Teacher's Guide](#)

- The [Water Walk Learning Activity](#) sets the stage for developing a baseline knowledge and interest in your Hydrosphere Study Site.
- The [Model a Catchment Basin Learning Activity](#) provides the big picture view of the students' watershed and the water and study site in relation to this watershed.
- Map Your Hydrosphere Study Site. At the beginning of your study as part of defining your site, and once each year thereafter, create a map of the Hydrosphere Site and take photographs.
- The [Practicing Your Protocols Learning Activity](#) guides students through learning how to use the instruments and following the protocols so they collect reliable data.
- Begin Field Sampling. Go to the site and begin the weekly measurements for water.
- Use the Looking at Data section at the end of each protocol as a guide to examine your data, ask questions and interpret what you find. Start linking water data to other GLOBE measurements.
- Focus on Key Science Ideas by performing the following Learning Activities:
  - [Water Detectives](#) and [The pH Game](#) introduce students to key water chemistry variables and to the need using instruments to take certain measurements.
  - [Modeling Your Water Balance](#) lets students explore how to use their data for modeling.



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## Credits

### Slides:

Russanne Low, Ph.D., University of Nebraska-Lincoln, USA

Rebecca Boger, Ph.D., Brooklyn College, NYC, USA

### Art and Illustrations:

Jenn Glaser, *ScribeArts*

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