What is water quality and how do scientists measure it?

What do scientists mean when they talk about water quality? Water quality describes the condition of water as determined by its biological, chemical, and physical characteristics. While *quality* is an indicator of how good or bad something is, determining water quality is more complex than simply saying the quality is "good" or "bad." Instead, scientists must consider how the water will be used in order to determine its quality. Scientists would want to know if the water is going to be used for drinking, for washing a car, for recreation (boating or swimming), for sustaining life in an ecosystem, or for industry and agriculture. This information is important for determining water quality because different standards are necessary to support different uses of water. For example, there are much higher standards for water that will be used for drinking or swimming than for water that will be used for washing a car or for industry.

To determine water quality in a particular place for a particular use, scientists measure several biological, chemical, and physical characteristics. These characteristics include the amount of solid material suspended in the water, the presence of chemicals such as phosphorus and nitrogen, the concentration of microscopic algae, the bacteria levels, and the quantities of herbicides, pesticides, and other contaminants in the water. Once scientists measure a variety of these characteristics and consider the purpose of the water, they can use their measurements as data to determine water quality. When water quality is poor, it can pose health risks to people and ecosystems.

Several characteristics that scientists measure and collect data on in order to determine water quality in Lake Erie are described in the table below. For more information about each characteristic, or indicator, see the sources in the right column.

Turn and Talk: Why would there be different standards for drinking water than for water used in industry?

Indicators	Description *What is it? Where does it come from? How is it measured?*	Sources
Precipitation (rainfall + snowfall, mm H20/day)	Precipitation is any type of water that forms in Earth's atmosphere and falls to Earth's surface as rain, snow, sleet, hail, etc. Precipitation is typically measured in inches (in) or millimeters (mm) per day. 1 millimeter is approximately 0.0393701 inches.	National Geographic Weather.Gov
Daily Discharge (Q) *Maumee daily river discharge at USGS station of Waterville, OH in m3/s	Daily discharge is the volume rate of water flow in a particular area. Discharge may include dissolved chemicals, biological material, or sediment (i.e., suspended solids). Runoff is one form of discharge. Runoff comes from precipitation, irrigation, or snowmelt that appears in rivers, surface streams, or drains. Daily discharge or runoff is typically measured in time rates, or cubic meters per second (m3/s).	U. S. Geological Survey - Glossary U. S. Geological Survey - Runoff
Predicting relationships: If precipitation increases, then daily discharge (Q) will _____.		
Suspended Solid (SS) *MT/day	Two forms of solids are found in streams: suspended solids and dissolved solids. Suspended solids include sediment, silt, decaying plant matter and are carried into streams in discharge or runoff. While dissolved solids will pass through a filter, suspended solids will not. Suspended solids (SS) are measured in metric tons per day. A metric ton (MT) is a unit of mass equal to 1,000 kilograms or approximately 2,205 pounds.	Water Quality - TDS Water Research Center Michigan.Gov Document
Predicting relationships: If precipitation increases, then suspended solids (SS) will _____.		
Total Phosphorous Load (TP) *MT/day	Phosphorus is a common component of fertilizers and manure used for agriculture. While phosphorus is a necessary nutrient for plant life, too much of it can cause problems in bodies of water like lakes and oceans. Excess phosphorus in a body of water may come from runoff that contains lawn and farm fertilizers, yard waste,	EPA U. S. Geological Survey

	stormwater, and industrial waste. Soil erosion also contributes to excess phosphorus in streams and other bodies of water. Total phosphorus load (TP) is a measure of all forms of phosphorus found in a sample and is measured in metric tons per day. A metric ton (MT) is a unit of mass equal to 1,000 kilograms or approximately 2,205 pounds.	South Central Eco Institute Water Research Center
Predicting relationships: If precipitation increases, then total phosphorus load (TP) will _____.		
Soluble Reactive Phosphorous Load (SRP) *MT/day	Soluble reactive phosphorus (SRP) is the portion of phosphorus that is readily available for algal growth. Whereas total phosphorus (TP) is a measure of all forms of phosphorus in a sample, soluble reactive phosphorus (SRP) is a measure of orthophosphate. Orthophosphate is the soluble portion of phosphorus. This portion is directly taken up by plant cells, like algae. Soluble reactive phosphorus (SRP) is measured in metric tons per day. A metric ton (MT) is a unit of mass equal to 1,000 kilograms or approximately 2,205 pounds.	Tahoe: State of the Lake Report 2014 General Information on Phosphorus
Predicting relationships: If precipitation increases, then soluble reactive phosphorus load (SRP) will _____.		
Nitrate + Nitrite Load (NO) *MT/day	Nitrate and nitrite are sources of nitrogen, which is an important nutrient for plant and algae growth. Levels of nitrate in surface water are typically low. However, fertilizer used for crops and lawns contains nitrate and can enter bodies of water in runoff. Nitrate + nitrite load (NO) is measured in metric tons per day. A metric ton (MT) is a unit of mass equal to 1,000 kilograms or approximately 2,205 pounds.	U.S. Geological Survey South Central Eco Institute Water Research Center EPA
Predicting relationships: If precipitation increases, then nitrate + nitrite load (NO) will _____.		

Total Kjeldahl Nitrogen Load (TKN) *MT/day	Nitrogen is an important nutrient for plant and algae growth. Three forms of nitrogen are typically measured in bodies of water: nitrates, nitrites, and ammonia. Total nitrogen is the sum of nitrate + nitrite and total Kjeldahl nitrogen (TKN). TKN is the sum of ammonia and organic nitrogen, but does not include nitrate + nitrite. Nitrogen is found in fertilizer used for crops and lawns and can enter bodies of water in runoff. Total Kjeldahl nitrogen load (TKN) is measured in metric tons per day. A metric ton (MT) is a unit of mass equal to 1,000 kilograms or approximately 2,205 pounds.	EPA ASA Analytics
Predicting relationships: If precipitation increases, then total kjeldahl nitrogen load (TKN) will _____.		
Average Algal Biomass or Biovolume from Thomas Bridgeman's research	Biomass is the weight or total amount of living organisms of an animal or plant, like algae, within a habitat. Thus, algal biomass is the weight or quantity of algae in a habitat. Biomass can be expressed as the weight of organisms per unit area or the volume of organisms per unit volume within in a particular location. ● Algal biomass can be measured in grams per square meter (g/m2). ● Algal biovolume can be measured in milliliters per cubic meter (ml/m3).	Science Daily Dictionary Britannica
Predicting relationships: If precipitation increases, then algal biomass will _____.		

Predicting relationships:
(1) Based on the information you currently have, predict how increases in the frequency and intensity of extreme precipitation events will impact water quality?

(2) How does the information you currently have support your prediction?

Additional Sources:

http://floridakeys.noaa.gov/ocean/waterquality.html

https://www.uaex.edu/publications/pdf/FSA-9528.pdf