What's in the Water?

Indicators of Water Quality

Citizen Science 2.0

CUYAHOGA VALLEY
ENVIRONMENTAL
EDUCATION CENTER

Water Quality Kit Tests

- pH
- Nitrates and Phosphates
- Dissolved Oxygen
- Turbidity

Photo courtesy Conservancy

What is pH?

- A measure of the concentration of hydrogen ions in solution
- An acid is a substance that *donates* hydrogen ions whereas a base is a substance that *accepts* hydrogen ions
- The pH will be less than 7 if an acid is dissolved in water and greater than 7 if a base (alkali) is dissolved in water; a pH of 7 is considered neutral
- Denoted on a numeric scale from 1 to 14

What causes changes in pH?

- Acid precipitation
- Industrial pollution
- Agricultural runoff

Why does pH matter?

- Aquatic organisms are sensitive to pH, especially during reproduction
- Changes in pH can alter protein function in organisms
- pH can affect the toxicity of many substances in the water

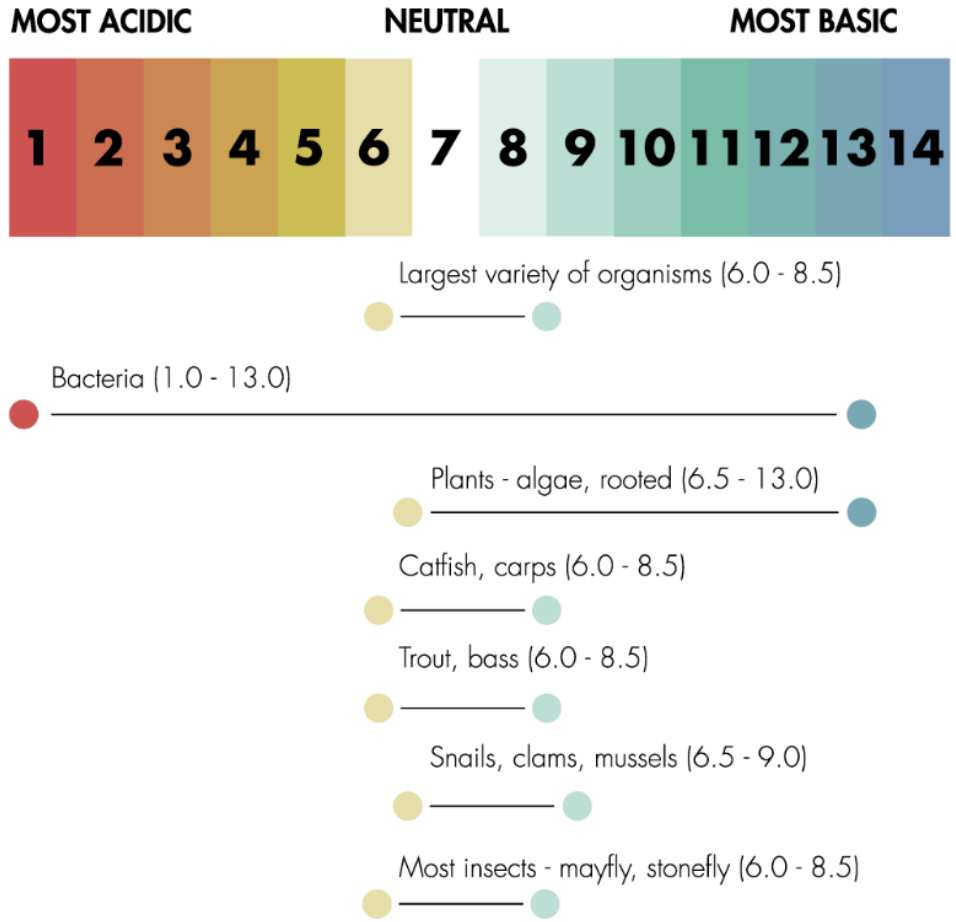


Diagram courtesy the Stroud Water Research Center's WikiWatershed Application: https://wikiwatershed.org

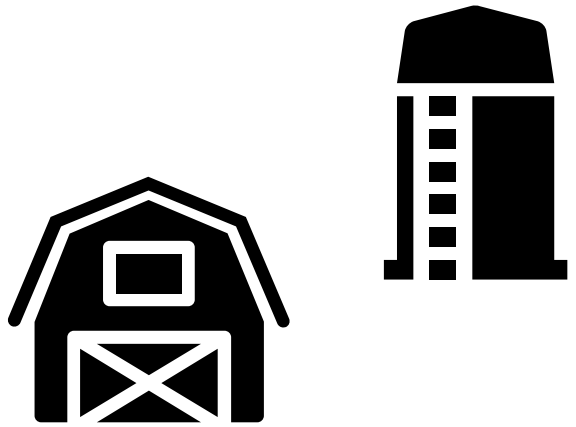
Based on the diagram, what pH range would be an indication of a healthy stream?

What are Nitrates and Phosphates?

- Forms of nitrogen and phosphorus that are essential nutrients for plants and algae
- Nitrates and phosphates are nutrients needed by all plants and animals to build protein and grow
- Orthophosphates are inorganic phosphates present in waterways that can easily be taken in by aquatic plants
- Often denoted in ppm or mg/L

What causes changes in Nitrate and Phosphate levels?

- Sewage discharges, failing septic systems, runoff from manure and industrial fertilizers, decomposition
- Excess phosphate can also be carried into waterways via soil erosion
- Rocks are a main reservoir for phosphorous in an ecosystem



Why do Nitrates and Phosphates matter?

- Nitrogen and phosphorous are considered limiting nutrients

- Excess nitrates and phosphates can cause increases in algae/plant growth leading to eutrophication and possibly hypoxia

Photo courtesy NASA Earth Observatory:
https://earthobservatory.nasa.gov/images/86327/algae-boom-in-lake-erie

Satellite imagery of toxic algal blooms in western Lake Erie in 2015. Excess algae growth was attributed to agricultural runoff.

What are acceptable levels of Nitrates and Phosphates?

Nitrates (mg/L)

Phosphates (mg/L)

Diagrams courtesy the Stroud Water Research Center's WikiWatershed Application: https://wikiwatershed.org

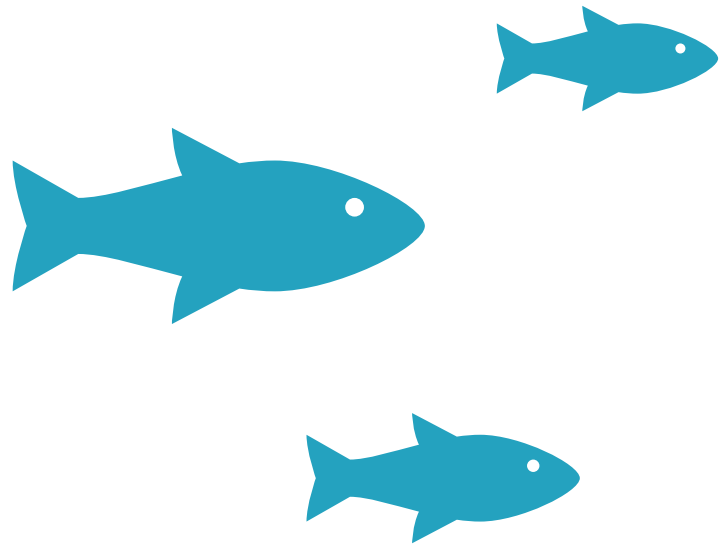
What is Dissolved Oxygen?

- A measure of the amount of oxygen dissolved in water
- Low or absent levels of dissolved oxygen (DO) indicate severe pollution
- A value of 71% oxygen saturation or greater is preferred
- Often denoted in ppm or mg/L

What causes changes in Dissolved Oxygen levels?

- Can be changed by temperature, photosynthesis, plant growth, decaying matter, water movement, and turbidity

- Colder water can hold more DO than warmer water



Why does Dissolved Oxygen matter?

- DO is fundamental to the survival of most aquatic organisms as it is used for cellular respiration
- Very low DO can lead to a condition called hypoxia and results in fish die-offs
- Some organisms are adapted to low DO levels and can ingest air directly

NPS Photo

Many aquatic life forms, such as fish and insect larvae, require acceptable levels of dissolved oxygen in the streams and rivers where they live.

What are acceptable levels of Dissolved Oxygen?

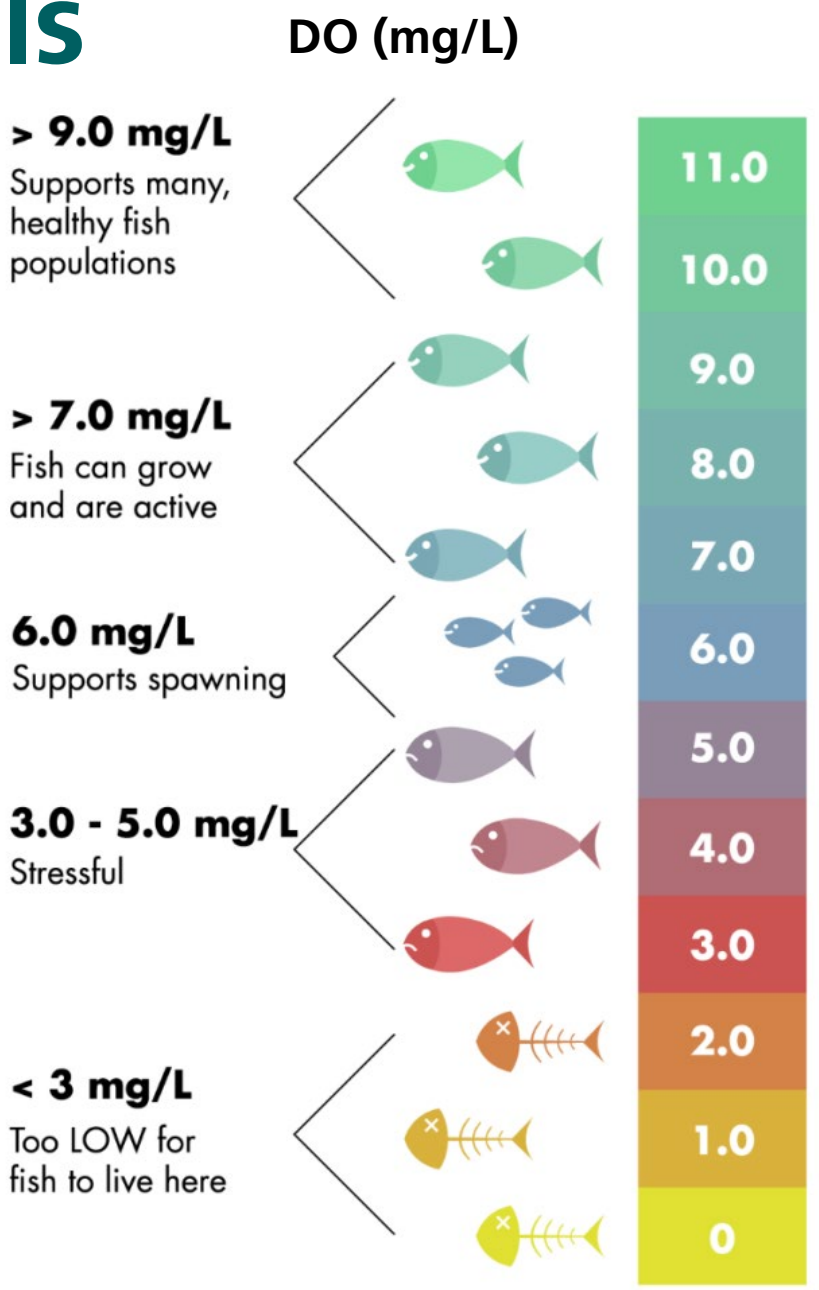


Diagram courtesy the Stroud Water Research Center's WikiWatershed Application: https://wikiwatershed.org

What is Turbidity?

- A measure of the clarity or relative cloudiness of the water
- Can be determined by using a turbidity tube (pictured)
- Often denoted in Nephelometric Turbidity Units (NTU)

Photo courtesy Conservancy

What causes changes in Turbidity?

Suspended particles from…

- Erosion
- Runoff
- Increased bacteria or algal blooms
- Sewage
- Industrial waste
- Decaying organic matter
- Weather events
- Human disturbance

Why does Turbidity matter?

- Excessive turbidity caused by suspended solids can impair photosynthesis, thus reducing DO
- Suspended particles can absorb heat and cause a rise in water temperature, thus DO may decrease and limit biodiversity

What are acceptable Turbidity levels?

Diagram courtesy the Stroud Water Research Center's WikiWatershed Application: https://wikiwatershed.org