

ALKALINITY FACT SHEET

Definition: Measure of ability to "resist change" in **pH** or the number of hydrogen ions (H⁺). Measure of acid neutralizing capacity and the ability to buffer.

Background:

- Without this acid-neutralizing capacity, acid added to a stream would cause an immediate change in pH - amount of free hydrogen ions (H⁺) in water. Extra hydrogen ions make water acidic.
- Amounts of **carbonates** (CO₃⁻²) and **bicarbonates** (HCO₃⁻) help determine alkalinity. They react with the free hydrogen ions, maintaining pH levels.
- Extra carbonate and bicarbonate provided by the interaction between **calcium carbonate** (CaCO₃ - a component in limestones and sandstones) and **carbonic acid** (H₂CO₃ - a natural acid that forms from water and carbon dioxide [H₂O + CO₂ → H₂CO₃]).

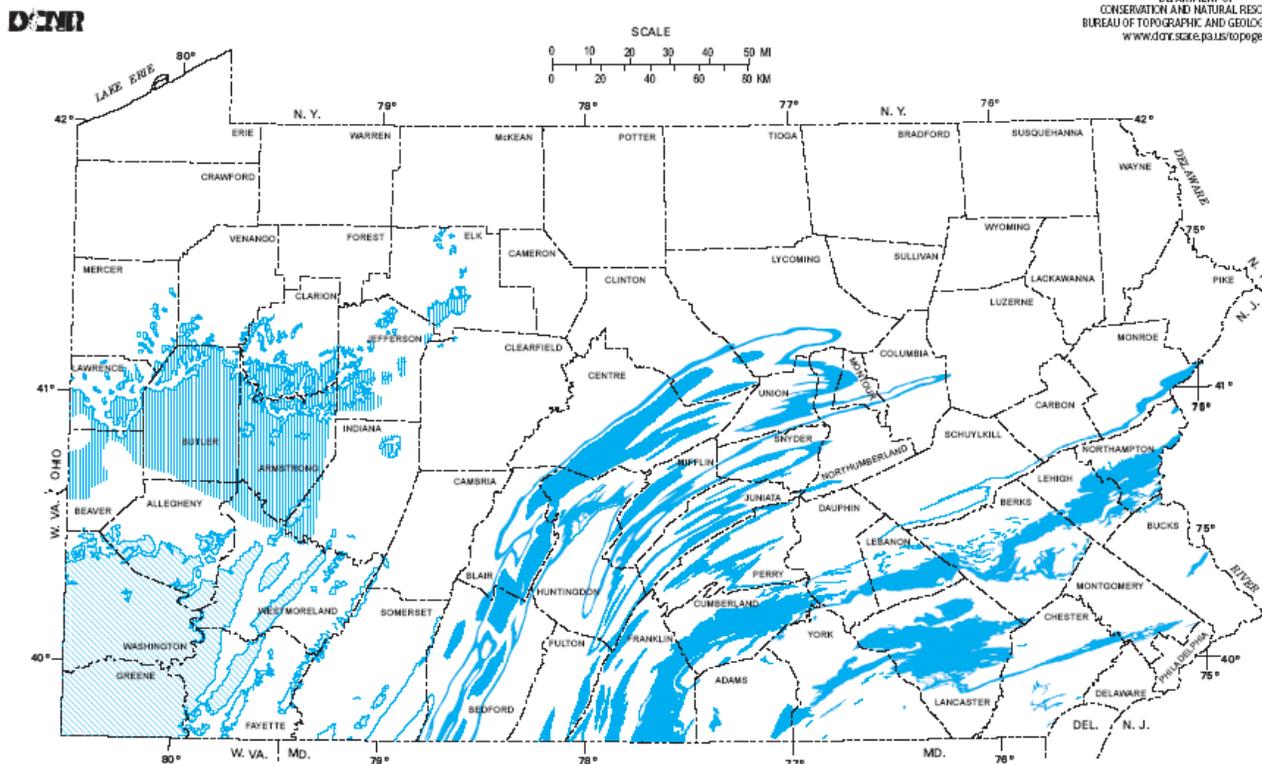
Alkalinity is influenced by:

- Rocks and soils – if an area’s geology contains calcium carbonate, the stream will have higher alkalinity.

MAP 15

LIMESTONE AND DOLOMITE DISTRIBUTION IN PENNSYLVANIA

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF
CONSERVATION AND NATURAL RESOURCES
BUREAU OF TOPOGRAPHIC AND GEOLOGIC SURVEY
www.dcnr.state.pa.us/topogeo



EXPLANATION

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| <p>Area where limestone, dolomite, or both are at the surface. Layers are usually strongly folded and steeply dipping. Includes economically important high-calcium limestones of the Kinross, Ansville, Fenner, and Keyser Formations and the Cockeysville Marble, as well as the high-magnesian dolomites of the Ledger Formation and the Cockeysville Marble. This area is most susceptible to sinkhole development.</p> | <p>Area underlain by flat-lying, generally thin, but locally thick, limestone beds, which are discontinuous in places and are commonly interbedded with shale.</p> | <p>Area underlain by the generally flat-lying Pennsylvanian Vancort limestone, a high-calcium limestone. This limestone is generally overlain by less than 100 feet of sedimentary rocks, except in the southern part of the area.</p> |

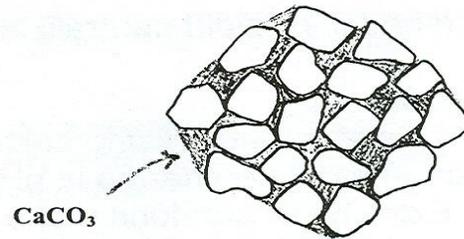
➤ Addition of lime (CaCO_3) – soil amendment (correction) often used to decrease acidity.

➤ Groundwater is well buffered after coming in contact with calcium carbonate rocks.

➤ Stormwater runoff does not have the chance to react with rocks to become buffered.

➤ Photosynthesis - removes CO_2 , thus lowering the chance to form carbonic acid, which reacts with calcium carbonate.

➤ Decomposition / respiration – adds CO_2 , increasing the chance to form carbonic acid, which reacts with calcium carbonate.



Sand particles held together by calcium carbonate to form a sandstone.

Carbon dioxide + water + **solar energy** → glucose + oxygen



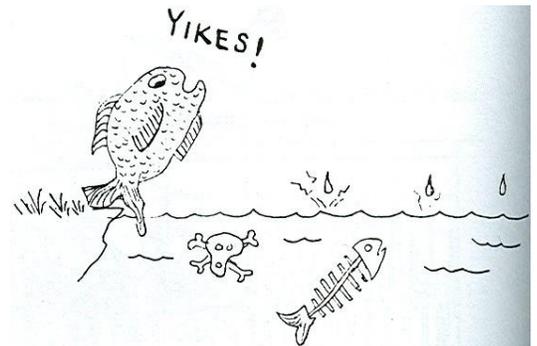
Glucose + oxygen → carbon dioxide + water + **energy**

Environmental Impacts:

- Water with low alkalinity is at risk of being affected by increased acidity (hydrogen ions)
- Acid rain can increase acidity if a stream has low alkalinity (New York's Adirondacks & Eastern Canada Lakes).
- Aquatic life cannot tolerate large changes in pH (level of acidity).
- Acid rain, if not buffered, can cause fish kills.

Water Quality:

The EPA considers 20 mg/L alkalinity a minimum for healthy aquatic life.



Link:

Monitoring Water Quality~General overview of alkalinity, and how to test for alkalinity.

<http://www.epa.gov/volunteer/stream/vms510.html>