

# ALKALINITY FACT SHEET

**Definition:** Measure of ability to "resist change" in **pH** or the number of hydrogen ions (H<sup>+</sup>). 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<sup>+</sup>) in water. Extra hydrogen ions make water acidic.
- Amounts of **carbonates** (CO<sub>3</sub><sup>-2</sup>) and **bicarbonates** (HCO<sub>3</sub><sup>-</sup>) help determine alkalinity. They react with the free hydrogen ions, maintaining pH levels.
- Extra carbonate and bicarbonate provided by the interaction between **calcium carbonate** (CaCO<sub>3</sub> - a component in limestones and sandstones) and **carbonic acid** (H<sub>2</sub>CO<sub>3</sub> - a natural acid that forms from water and carbon dioxide [H<sub>2</sub>O + CO<sub>2</sub> → H<sub>2</sub>CO<sub>3</sub>]).

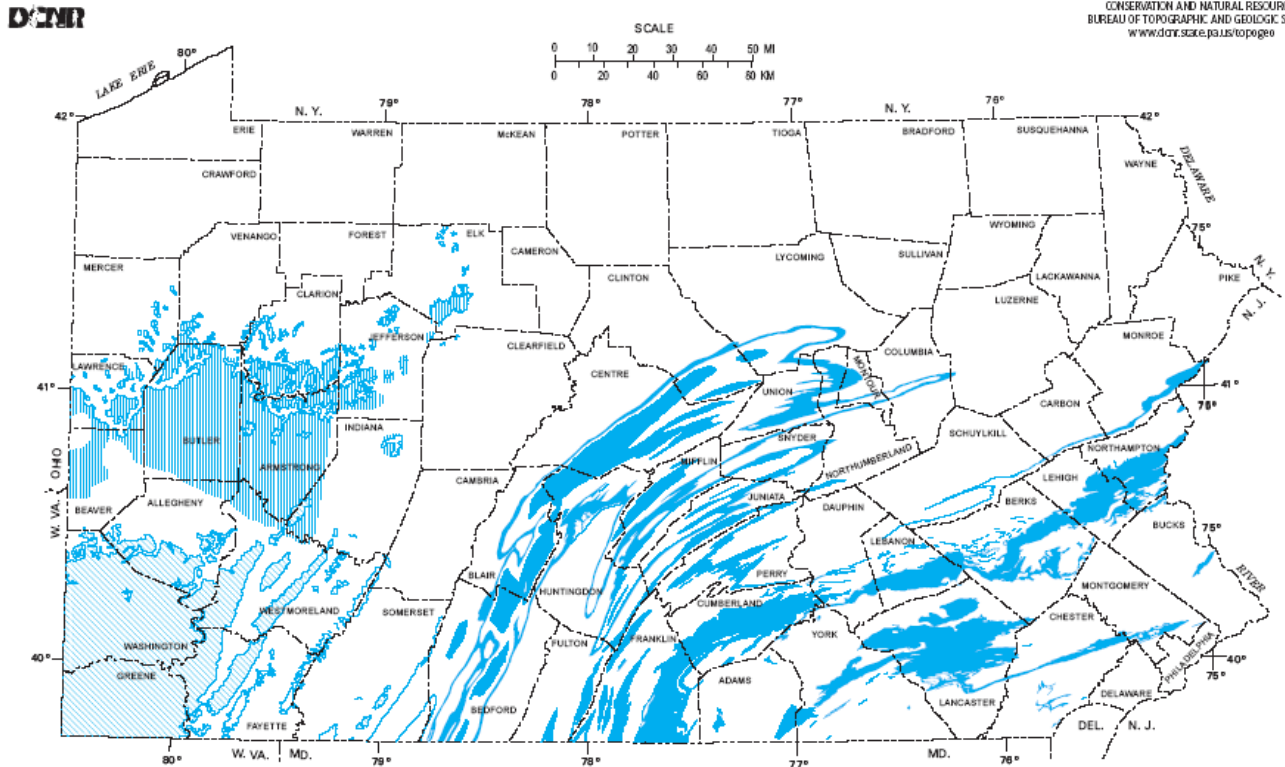
Alkalinity is influenced by:

- 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**

- |  |  |  |
|--|--|--|
|  |  |  |
| <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 Kinzua, 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> |

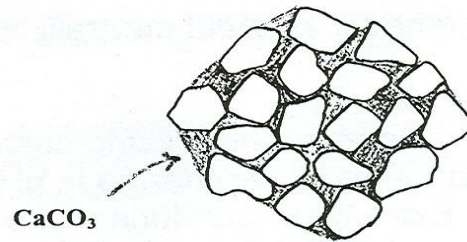
➤ Addition of lime ( $\text{CaCO}_3$ ) – soil amendment (correction) often used to decrease acidity.

➤ 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  $\text{CO}_2$ , thus lowering the chance to form carbonic acid, which reacts with calcium carbonate.

➤ Decomposition / respiration – adds  $\text{CO}_2$ , 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.

