ALKALINITY FACT SHEET

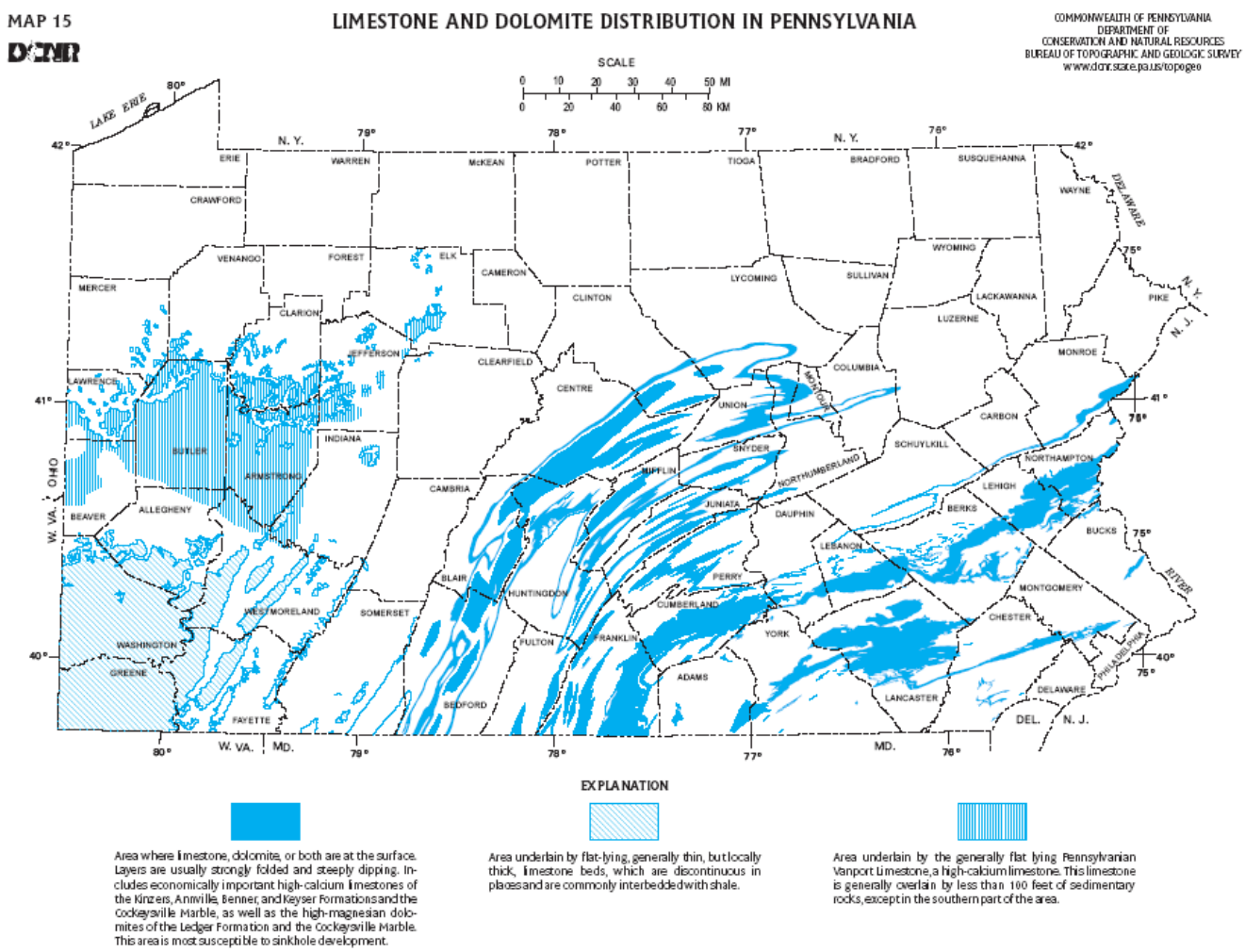
Definition: Measure of ability to "*resist change*" in **pH** or the number of hydrogen ions (H^+). Measure of acid neutralizing capacity and the ability to buffer.

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** (CO_3^{-2}) and **bicarbonates** (HCO_3^-) help determine alkalinity. They react with the free hydrogen ions, maintaining pH levels.
- Extra carbonate and bicarbonate provided by the interaction between **calcium carbonate** ($CaCO_3$ - a component in limestones and sandstones) and **carbonic acid** (H_2CO_3 - a natural acid that forms from water and carbon dioxide [$H_2O + CO_2 \rightarrow H_2CO_3$]).

<u>Alkalinity is influenced by:</u>

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

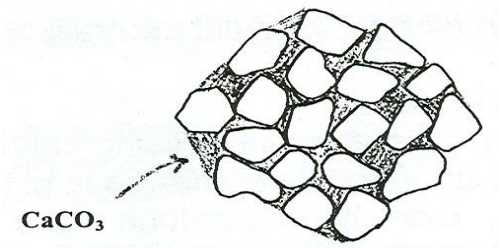


- Addition of lime ($CaCO_3$) – soil amendment (correction) often used to decrease acidity.

- 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.



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

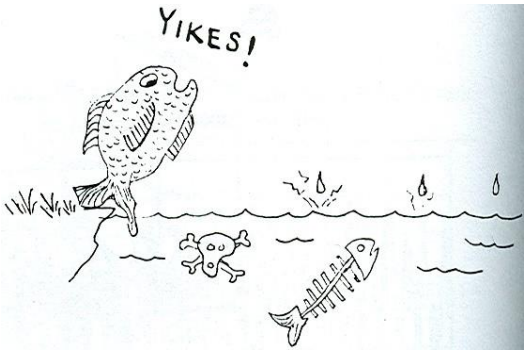
- Decomposition / respiration – adds CO_2, increasing the chance to form carbonic acid, which reacts with calcium carbonate.

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