



## WEST PENN TRAIL at GREEN RIVER OVERLOOK

The water in the Conemaugh River is not blue, but green because the water is contaminated with a green salt, named ferrous sulfate, that is carried into the river by streams of water leaking from abandoned coal mines and piles of mine shale. The Conemaugh River is probably the most polluted stream east of the Mississippi because the Conemaugh River drains one of the most extensively mined coal fields in the world.

The main contaminants in coal mine effluent are sulfuric acid and certain iron compounds. Those impurities are formed from the mineral pyrite, a compound of iron (Fe) and sulfur (S) that is found in coal in the form of yellow specks also known as "fool's gold".

When rain water percolates underground, through a coal bed, the water reacts with the pyrite, with help from air; the iron sulfide (FeS) is oxidized to form ferrous sulfate [FeSO<sub>4</sub>]. The ferrous sulfate dissolves in ground water trickling through the coal bed and so is transported out of the mine and so into the receiving stream, here the Conemaugh River. Water issuing from mines splashes over stones in stream beds and thus becomes mixed with oxygen from the air; oxygen converts ferrous sulfate into ferric sulfate [Fe<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>]. The ferric sulfate, in turn, reacts with water to form the two final products, sulfuric acid [H<sub>2</sub>SO<sub>4</sub>] and ferric hydroxide, Fe(OH)<sub>3</sub>.

Ferric hydroxide is not soluble in water, so it precipitates as a yellow-red powder seen along many streams. That stain was called "yellow boy" by coal miners, or "sulfur", by other people, but there is no sulfur in the deposit, for it is iron oxide, the same harmless substance (rust) used in facial rouge and lipstick.

It is not unusual, in the Conemaugh River basin, for just one abandoned coal mine to discharge ten thousand pounds of sulfuric acid daily, and with it, the iron chemicals, at concentrations as high as 10 ppm (parts per million). Sulfuric acid kills aquatic life and also corrodes concrete structures, such as Conemaugh Dam, and bridge piers.

The green color of the Conemaugh River is most noticeable when the water level is low – that is, when the ferrous sulfate is concentrated in a small volume of water. Rains swell the river and so dilute the green color, and often mask the color with suspended mud.

The green color is also an indicator of acidity (pH); if the water becomes less acidic (more alkaline), the color of the river will change to orange, by increased precipitation of iron hydroxide.

That condition is visible in the pool behind the Loyalhanna Dam; the outflow stream from that pool, seen at Saltsburg, is an orange band near the west shore, not mixed with the green flow in the Conemaugh River.