

## **Wells Creek Watershed Association Summary of Projects**

The Wells Creek Watershed Association (WCWA) along with their various partners has installed three different passive treatment systems within the last year. These treatment systems have been online for less than one year, but initial studies have shown significant improvement in water quality as documented by water analyses and macro-invertebrate evaluations. Thus, trout were stocked in the spring of 2004 in sections of Wells Creek, which were incapable of supporting fish since the early industrialization of the Wells Creek watershed in the late 1800's to early 1900's. We believe these fish are doing just fine in Wells Creek since there have not been any negative reports of fish kills (except for an occasional harvest by a fisherman).

Currently, WCWA is assessing the **Ritter Mine** discharges near Coleman Station and the **Consolidated Coal Company's Mine #115** discharges near Listie along Cemetery Road for water quality and flow. This work is being completed with the intent of installing additional treatment systems if the collected data deems it is necessary. Additionally, WCWA members and their partners are handling the required flushing and monitoring of the existing treatment systems.

The following is a summary generally describing the components of each treatment system. The basic concept of all the treatment systems is to raise the pH of the discharge water with limestone rock while in the absence of oxygen. The reason for this method of operation is to minimize the reaction of oxygen with metals and their subsequent precipitation while in contact with the limestone. Precipitated metal oxides tend to coat or "armor" the limestone and thus render it un-reactive. The polishing ponds are used to aerate the water and allow sufficient time for metal oxides to settle to the pond bottom. This concept is the same for each of these treatment systems. The difference between the treatment systems is how the discharge water lacking oxygen is created and delivered to the high quality limestone rock.

### **Skeria/Brown (Discharge #6) Treatment System**

The raw discharge water flow ranges from approximately 70 gallons per minute (gpm) to greater than 3,000 gpm. The average flow is around 363 gpm. The raw water has an average pH around 3.5, with average concentrations of iron, aluminum, and manganese of 1 mg/L, 3 mg/L, and 1 mg/L, respectively. The acidity ranges from 32 to 90 mg/L and alkalinity is non-existent.

The installed treatment system is commonly referred to as an Anoxic Limestone Drain (ALD). Anoxic means "lacking oxygen", Limestone refers to the rock installed in the treatment system to raise the pH, and Drain indicates the passive flow of water through the treatment system.

Typically, raw water discharging from a deep mine lacks oxygen. This is due to active chemical processes within the former deep mine, which remove oxygen from water passing through the matrix of mine tunnels. The water inside a deep mine is also typically pooled and lacks a method of aeration. Therefore, the design of the treatment system at this site allowed the discharge water to enter directly into the ALD. The ALD is constructed with 2,168 tons of limestone in the core, and it is then sealed with both a bentonite liner and 4 to 20 feet of cover material. The discharge water passively moves through the ALD by gravity flow and comes in contact with the high quality limestone. This raises the pH of the water and causes the metals to be susceptible to precipitation. Aluminum compounds can precipitate in the oxygen free environment of the ALD and forms a gelatinous material, which accumulates within the drain. Iron compounds remain in solution until coming in contact with oxygen outside of the ALD where they precipitate in the two sediment ponds. The volume of Pond #1 is 55,300 cubic feet and Pond #2 is 37,900 cubic feet. During average flows, the volume of these ponds allows for a retention time of 32 hours. Another component of this treatment system is the ability to conduct a high velocity internal flush using an engineered piping system, which allows precipitated metals and dirt to be flushed out of the ALD into Pond #1. The final component of the treatment system is a 200 foot long limestone lined discharge ditch.

The ALD has improved the water quality from this discharge by increasing the pH from 3.5 to 6.8, providing excess alkalinity at a rate of 109 pounds per day, and reducing metals at a rate of 10.7 pounds per day.

Due to higher than expected flows in the Spring of 2004, excessive water pressures caused damage to the ALD and an adjacent pond. WCWA will correct this problem this fall. The planned corrective action will allow excess water to by-pass the treatment system via an 18-inch pipe, and thus, prevent the build-up of water pressure within the deep mine.

#### **Moore/Butterbaugh (Discharge #7) Treatment System**

The raw water flow for this discharge ranges from approximately 86 gallons per minute (gpm) to greater than 1,500 gpm. The average flow is around 375 gpm. The raw water has an average pH around 3.3, with average concentrations of iron, aluminum, and manganese of 10 mg/L, 5 mg/L, and 5 mg/L, respectively. The discharge's acidity ranges from 54 to 138 mg/L and alkalinity is non existent.

The type of treatment system installed here is commonly referred to as a Vertical Flow Pond (VFP). The term "vertical flow" refers to the downward flow of water in a pond through an 8-inch layer of mushroom compost and then a layer of high quality limestone. The layer of mushroom compost supports an active population of biological organisms that use oxygen from the discharge water. Subsequently, the discharge water in the absence of oxygen comes in contact with the limestone and the pH of the water increases. The metals react similarly as described previously in the ALD system. The treated water flows by gravity into a pipe collection system, which carries the water to the Polishing Pond. Here the water is aerated and the metals are allowed to settle out of suspension. The treatment system also consists of a 0.07 acre wetland, which carries the discharge water through an extensive rock refuse area to the treatment system; a 68 foot long limestone lined discharge ditch; a two layered-eight section flush system installed in the VFP; and a diversion ditch 2,283 feet long.

The VFP consists of over 3,800 tons of high quality limestone. The retention time of the Polishing Pond is designed for 41 hours at average flows.

The passive treatment system has improved the pH of Discharge #7 from 3.3 to 6.4, provided excess alkalinity at a rate of 121 pounds per day, and reduces metals at a rate of over 44 pounds per day.

#### **Onstead (Discharges #5, #5A, and #11) Treatment System**

The water being treated in this system is a combination of three different discharges labeled as Discharges #5, 5A, and #11. The raw water flow for this discharge ranges from 60 gpm to over 500 gpm. The design flow for the treatment system was 100 gpm. The raw water has an average pH around 3.5, with average concentrations of iron, aluminum, and manganese of 2.5 mg/L, 4 mg/L, and 2.5 mg/L, respectively. The discharge's average acidity is around 60 mg/L and alkalinity is non existent.

The installed treatment facility consists of sandstone and pipe discharge collection systems, which feed into a VFP. The VFP is constructed and operates similarly to the system at the Moore/Butterbaugh Site. The treated water flows into a sedimentation pond where the water is aerated and the solids fall out of suspension. The VFP was also supplied with a flush system to prevent the VFP from clogging.

The treatment system has improved the pH of this discharge water from 3.5 to about 7.0.

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We are just beginning to make things happen and need your long-term  
commitment to help with the rebirth of Wells Creek into a community  
asset. Its your home, make it a place to dream about!!**