Abatement of Shale Bank Discharge

Site Investigation

8 piezometers were installed to aid in the determination of the water-bearing zones of interest. Based on this information, a exploratory sump was excavated to intercept the contributory flow associated with the shale bank seeps in question. Water samples were collected and flows estimated, this information was needed for design.

Raw Water

Samples collected 10/24/00 of the discharge to be treated indicate the total iron and manganese concentrations to be 85 mg/L and 12 mg/L, respectively. Following Hedin et al., 1994, the calculated acidity would be about 174 mg/L as $CaCO_3$. The average of three alkalinity measurements taken in the field was 117 mg/L as $CaCO_3$. The pH of the raw water was 6.0 s.u. The flow was visually estimated to be about 5 gpm.

Treatment Considerations

The net acidity of the water based on the above noted parameters would be 57 mg/L as $CaCO_3$. In order to have net alkaline water, the proposed ALD must generate a minimum of 57 mg/L as $CaCO_3$ (i.e. have a discharge alkalinity in excess of 174 mg/L as $CaCO_3$). Based on current long-term evaluations of anoxic limestone drains by the US Department of Energy (Watzlaf et al., 2000), a total alkalinity of about 200 mg/L $CaCO_3$ is expected.

Anoxic Collection System (ACS)

Water is to be collected in a french drain-type system to maintain anoxic conditions. The system is designed to collect the water and direct flow to an anoxic limestone drain. An impermeable barrier will be installed on the downslope side of the drain. This barrier is designed to inhibit water from continuing to flow through the water-bearing zone of bedrock material to the shale bank located adjacent to the unnamed tributary to Laurel Run.

Anoxic Limestone Drain (ALD)

200 Tons of high calcium carbonate limestone will be installed and buried under 3 or more feet of cover. The discharge from the anoxic collection system will be distributed along the inlet end of the ALD via a perforated manifold. The water will flow through the limestone with a calculated retention time in excess of 12 hours. Water will be collected at the discharge end with another manifold system and directed into the aerobic wetland.

Aerobic Wetland (WL)

A wetland will be installed which will include a deeper dug-out section at the inlet end and a shallower, planted area for the remainder of the surface area. The dug-out section will provide room for the accumulation of iron solids. The shallower, planted area will provide filtering and additional settling/accumulation area to remove the remainder of the iron. According to Hedin et al., 1994 the typical removal rate for aerobic-type wetlands is 10-20 grams/square meter/day; however, the proposed wetland has been more conservatively sized at a removal rate of 5 grams/square meter/day.

Spoil Drain

A spoil drain has been installed which, based on water samples taken 10/24/00, yields a discharge containing about 463 mg/L alkalinity as $CaCO_3$, 2.5 mg/L total iron, 1.0 mg/L total aluminum, and 13.8 mg/L total manganese. The flow from the spoil drain was visually estimated to be about 7 gpm. A pipe and valve system will be installed which will allow the manipulation of flow from the drain to provide additional alkalinity to the system at the inlet or outlet of the aerobic wetland. A bypass system for the spoil drain water will also be installed.