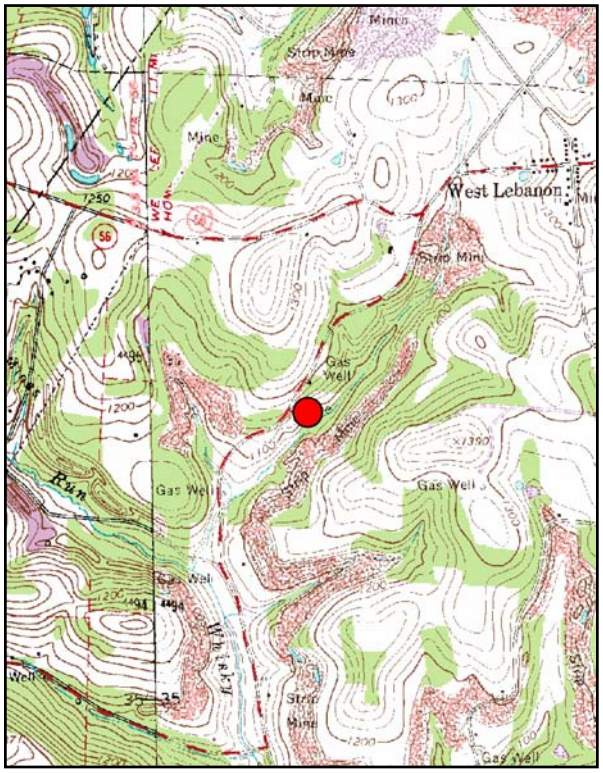
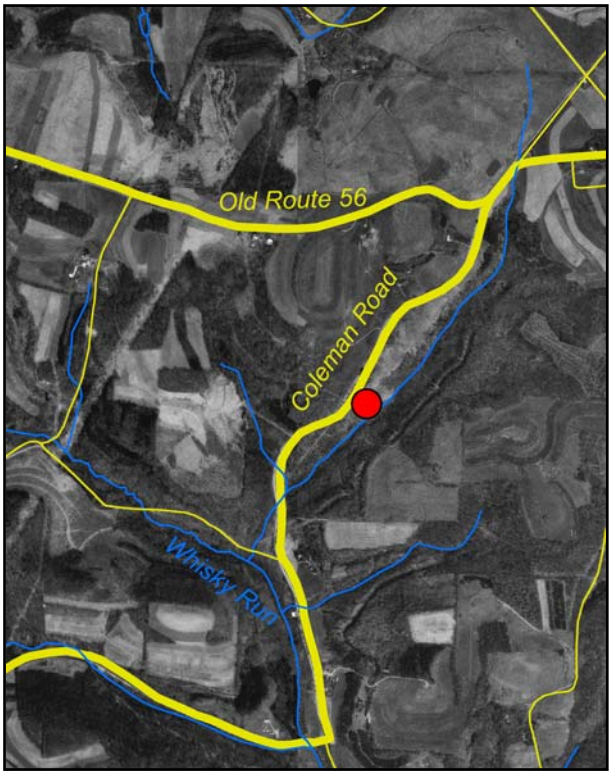
WR9

This major discharge exits an old mine opening located near a bony pile and travels approximately 50 yards before entering a tributary to Whisky Run. High levels of aluminum and iron are present.

Photo of WR9



WR9 (Avonmore and McIntyre DRG)



WR 9 (Avonmore NE and McIntyre NW)

Table 14. Discharge WR9 Chemistry	
Parameter	**Average (n=14)**
Flow	361.0 gpm (n=5)
pH	5.9
Calculated Acidity	40.9 mg/L
Alkalinity	67.3 mg/L
Iron	2.1 mg/L
Aluminum	3.4 mg/L
Manganese	9.5 mg/L

Conceptual Treatment Consideration

At the pH observed for this discharge, all that may be required for treatment is alkalinity addition combined with aeration to promote metals precipitation and ponds and/or wetlands for metals precipitation. A limestone-lined channel may serve to aerate the discharge water while adding additional alkalinity and directing the discharge water to a settling pond. In the settling pond, metals will oxidize, precipitate, and settle within the pond. If site conditions permit, additional channels and ponds may be constructed with an aerobic wetland for final metals polishing at the end of the system. The system would be designed to balance metals retention and the potential to create thermal conditions unsuitable for trout due to long residence times within the ponds. This condition could be enhanced by utilization of a buried limestone bed as the last system component to add excess alkalinity and serve to cool the water prior to discharge. Although some flow data are available for this site, it is recommended to collect additional data prior to proceeding with a detailed design or cost estimate.

Treatment Status

As of the time of this report, a grant proposal has been submitted to DEP's Growing Greener Program to fund the design, construction package, and pre-permitting tasks associated with Phase I of this treatment system. This specifically includes site characterization, map development, hydrological investigation, system design, specifications, pre-permitting tasks, and meetings. Based on February 2005 measurements of filtered and unfiltered water samples, it was found that the conceptual design including a settling pond, followed by an alkaline-amended aerobic wetland, will be appropriate for this discharge. If the grant proposal is approved, additional samples for total and dissolved metals will be taken to confirm the appropriateness of this design. Preliminary data indicates that Discharges WR1, WR2, WR3, and WR9 may be part of the same mine pool. Hydrological investigations will determine whether it is possible to get any of these other discharges to emerge at the WR9 location, which may beneficial given that there is little room for treatment at these other sites. Robindale Energy currently owns the property adjacent to WR9 and is planning on having the refuse at the site removed by 2008. Given this information and the further investigation that is needed, a treatment system is tentatively scheduled for construction in 2008.

WR10

This small seep is located adjacent to a tributary of Whisky Run. Located about 10 yards from site WR11, site WR10 is dry during much of the year and has a low flow. It is considered a low priority.

Photo of WR10

WR11

This discharge emanates from a mine opening on a reclaimed strip mine site. The discharge flows at least 100 yards before entering a tributary to Whisky Run. It travels through a wooded area behind a large coal refuse pile that has been turned into an illegal garbage dump. The discharge shows the presence of aluminum.

Table 15. Discharge WR11 Chemistry	
Parameter	**Average (n=5)**
Flow	Unknown
pH	4.4
Calculated Acidity	40.9 mg/L
Alkalinity	7.0 mg/L
Iron	1.2 mg/L
Aluminum	14.5 mg/L
Manganese	6.2 mg/L

Photo of WR11

Conceptual Treatment Consideration

The low average iron concentrations indicate that a vertical flow wetland-type system may not be required. However, one sample collected showed an anomalously high iron concentration, resulting in a somewhat misleading average iron concentration. Excluding this sample from the average produces an average iron concentration of 0.6 mg/L. It is believed that a limestone pond may be appropriate for treatment of this discharge. Elevated levels of aluminum indicate that a flushing system for aluminum precipitates is necessary. Based on the water chemistry, this discharge is a good candidate for passive treatment. However, before an

appropriate system can be sized and designed for this discharge, it is recommended to collect flow data on a monthly basis for one year.

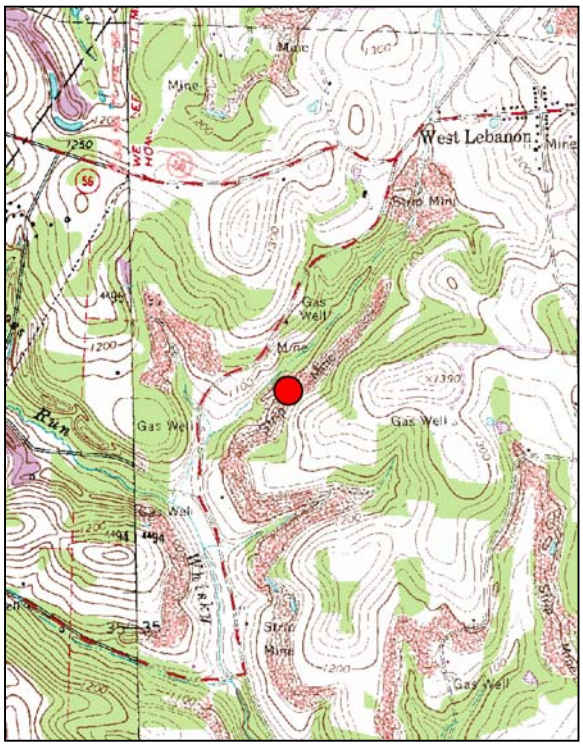
WR11 (Avonmore and McIntyre DRG)

WR11 (Avonmore NE and McIntyre NW)

WR12

This discharge consists of a large seep originating from behind a bony pile. The discharge has significant filamentous algal growth. This discharge comes out of the hillside at several locations. The treatment options are limited due to the presence of the bony pile. However, there is the possibility of removing the coal refuse, which may allow for suitable area to treat the water.

Photo of WR12



WR12 (Avonmore and McIntyre DRG)

WR12 (Avonmore NE and McIntyre NW)

Table 16. Discharge WR12 Chemistry	
Parameter	**Average (n=5)**
Flow	Unknown
pH	3.4
Calculated Acidity	139.1 mg/L
Alkalinity	0
Iron	0.9 mg/L
Aluminum	19.0 mg/L
Manganese	6.4 mg/L

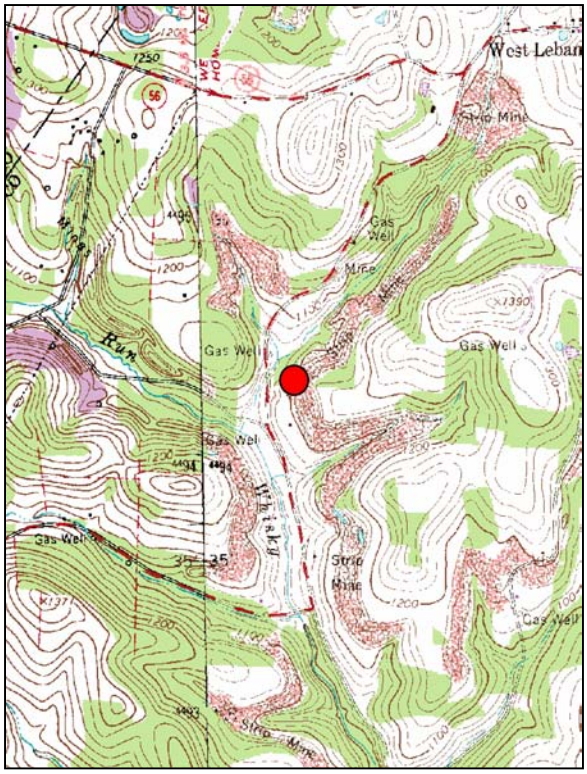
Conceptual Treatment Consideration

It is believed that a limestone pond is appropriate for the treatment of this discharge. Elevated concentrations of aluminum indicate that a system for flushing aluminum precipitates from the limestone bed will be required. Based on the water chemistry, this discharge is a good candidate for passive treatment. However, before an appropriate system can be sized and designed for this system, it is recommended to collect flow data on a monthly basis for one year.

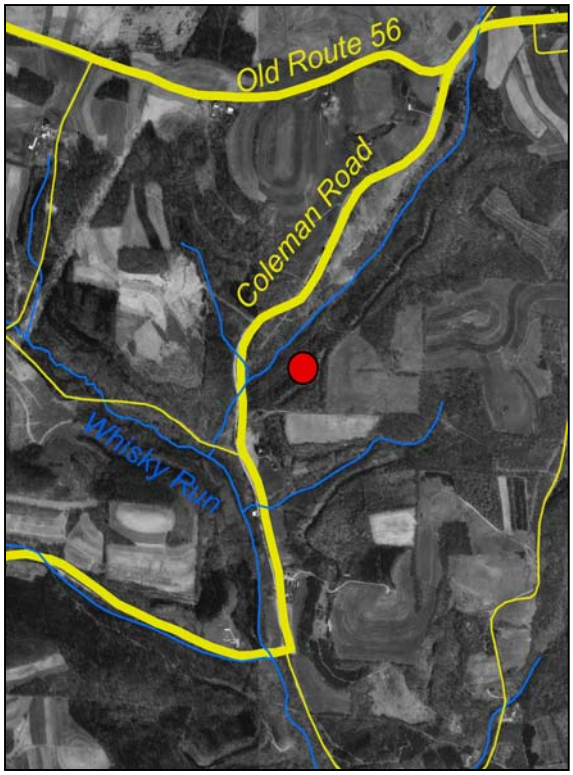
WR13

This discharge is located near a Bureau of Abandoned Mine Reclamation (BAMR) project and travels a approximately 300 yards to a tributary of Whisky Run. The flow of this highly acidic discharge (pH~3.5) is less than 5 gpm. A large wetland area, fed by the AMD, lies adjacent to this discharge.

Photo of WR13



WR13 (Avonmore and McIntyre DRG)



WR13 (Avonmore NE and McIntyre NW)

Table 17. Discharge WR13 Chemistry	
Parameter	**Average (n=5)**
Flow	Unknown
pH	3.3
Calculated Acidity	160.3 mg/L
Alkalinity	0
Iron	6.0 mg/L
Aluminum	20.0 mg/L
Manganese	5.9 mg/L

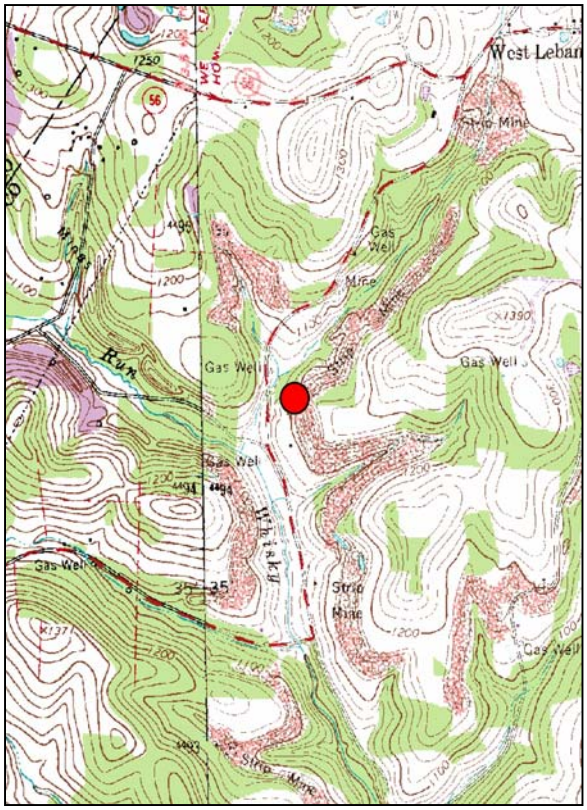
Conceptual Treatment Consideration

The elevated iron concentrations in this discharge dictate the need to incorporate measures to prevent the armoring of the limestone with iron precipitates. In this case, it is believed that a vertical flow wetland may be appropriate for this purpose. In addition, the high concentrations of aluminum require an aggressive system for flushing aluminum precipitates from the limestone bed. However, based on the water chemistry, this discharge is still a good candidate for passive treatment. Before an appropriate system can be sized and designed for this discharge, it is recommended to collect flow data on a monthly basis for one year.

WR14

This discharge is a seep that joins WR13 and flows more than 300 yards before entering a tributary of Whisky Run. The flow of this highly acidic pH is estimated to be around 5-10 gpm. Treatment options are limited, due to other discharges running alongside of WR14. There is the potential to treat both discharges at the same time. The discharge is located within a forested area with some wetlands present.

Photo of WR14



WR14 (Avonmore and McIntyre DRG) ***WR14 Avonmore NE and McIntyre NW***

Table 18. Discharge WR 14 Chemistry	
Parameter	**Average (n=4)**
Flow	Unknown
pH	3.4
Calculated Acidity	105.3 mg/L
Alkalinity	0
Iron	0.4 mg/L
Aluminum	13.8 mg/L
Manganese	4.3 mg/L

Conceptual Treatment Consideration

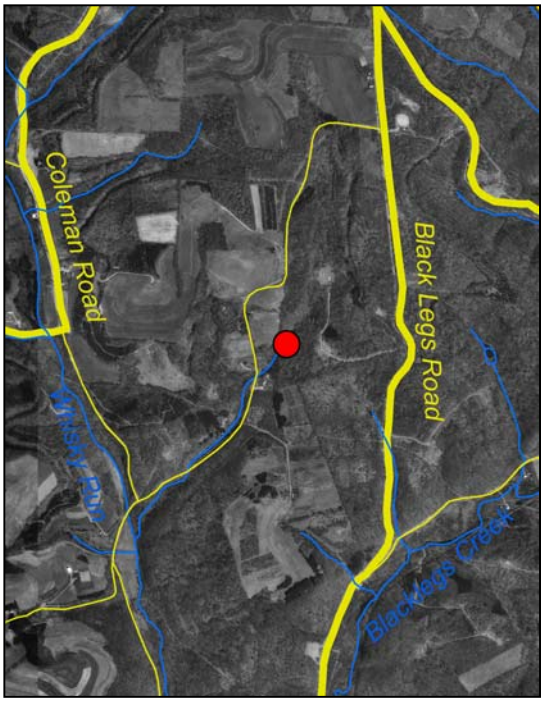
The combination of low iron and high aluminum in this discharge indicate that a limestone pond may be appropriate for treatment of this discharge. Aluminum flushing will be an integral part of this passive treatment system. Based on the water chemistry, this discharge is a good candidate for passive treatment. However, before an appropriate system can be sized and designed for this discharge, it is recommended to collect flow data on a monthly basis for one year.

WR19

This discharge originates at an old "burn out" bony pile. The pH is ~4.14 and the estimated flow is estimated at 50-100 gpm. A significant amount of burnt coal refuse lies within the valley. Prior to mining, this was a freshwater stream, but this waterway is currently considered "dead." The area surrounding the discharge consists of a large wetland complex, leaving little opportunity for treatment near the discharge site. There is no defined discharge location, rather several small seeps coming together to produce the flow.

Photo of WR19

WR19 (McIntyre DRG)



WR19 (McIntyre NW)

Table 19. Discharge WR19 Chemistry	
Parameter	**Average (n=4)**
Flow	Unknown
pH	6.3
Calculated Acidity	105.3 mg/L
Alkalinity	96.3 mg/L
Iron	2.9 mg/L
Aluminum	5.5 mg/L
Manganese	1.4 mg/L

Conceptual Treatment Consideration

The water quality data from the few samples taken thus far are highly variable for this discharge. Most of the samples indicated that the discharge is net alkaline. However, one of the samples shows strongly acidic chemistry. Based on the net alkaline results, a limestone-lined channel is suggested to aerate the discharge water while adding additional alkalinity and directing the discharge water to a settling pond. In the settling pond, metals will oxidize, precipitate, and settle within the pond. If site conditions permit, additional channels and ponds will be constructed with an aerobic wetland for final metals polishing on the tail end of the system. In addition, due to its variable chemistry, it is recommended that a limestone pond be incorporated at the downstream end of the system. This limestone pond could be buried to reduce impacts of thermal warming and would ensure consistent alkaline system effluent despite variation of the influent. The system will be designed to balance metals retention and the potential to create thermal conditions unsuitable for trout due to long residence times within the ponds. Although some flow data are available for this site, additional data are required prior to proceeding to advanced stages of design.