Weaver Run D10 Passive Treatment System
SRI O&M TAG Project #42 Request #1
OSM PTS ID: PA-315

Requesting Organization:	Kiski-Conemaugh Stream Team
Receiving Stream:	Weaver Run
Watershed:	Paint Creek
Municipality/County:	Paint Township, Somerset County
Latitude/ Longitude:	40°12'43.9596"N / 78°49'21.9468"W

The Weaver Run D10 passive treatment system was constructed to treat AMD from an underground coal mine. The AMD flows out of the mine into a collection basin with three perforated 12" PVC pipes that are connected to a 12" solid Schedule 40 PVC pipe to convey the flow to a 12' deep pre-cast concrete inlet box connected to another 12" PVC pipe that then conveys the water to the treatment system. The system was designed so that the AMD would first enter the southeastern corner of the Forebay (aka inlet pool). A cement level spreader about 6" thick sits on top of the limestone. The intention of the Forebay is likely to settle leaves and debris and to spread the water across the width of the pond while the level spreader is intended to evenly distribute the water within the treatment media. The actual treatment component consists of a single 75' X 180' open limestone bed that is about 7' thick where the water flows horizontally through the treatment media. A "pipe tree manifold" with perforated vertical pipes is located at the opposite end of the bed to collect the treated water and is connected to an Agri Drain water control structure.

In November of 2015, Missy Reckner of the Kiski-Conemaugh StreamTeam and Paint Creek Regional Watershed Association requested Technical Assistance related to the treatment system. Her primary concerns were decreased treatment performance, difficulty flushing, differences in flow rates in and out of the system, potential short-circuiting, a seep zone that had developed on the steep outer slope of the berm, and possible slope instability of the outer berm.

A site visit was conducted with Missy on December 17, 2015. The group had previously placed stakes in the ground and were periodically measuring the distance between them to see if the ground has been moving. Measurements so far are somewhat inconclusive, but may indicate some slight movement. She had also pointed out locations along the concrete level spreader that were cracked/broken and places where repairs had been attempted. Very little water was flowing over the level spreader as most of the water was flowing underneath.

During the site visit, a dye test was conducted to try to assess whether short-circuiting was occurring. The dye test was somewhat inconclusive because much of the dye stuck to the algae growing within the Forebay; nonetheless, certain information was revealed. The dye plume initially and quickly went towards the middle and northwestern end of the Forebay and began to make its way into the limestone bed within about 20 minutes, but then the dye stopped moving forward and developed a very discernible line across the Forebay. This point is believed to represent the approximate location of where the water is entering the stone and where the algae is growing on top of the stone, thus absorbing the dye. No dye was ever observed in the effluent before leaving the site; however, this was not necessary to determine short-circuiting. While waiting for the dye test to progress, pH measurements of the water within the 8 ports of the “pipe tree” were measured where possible. The ports were numbered 1-8 from the southeast to northwest with 8 being closest to the Agri Drain outlet of the bed. As can be seen in the table below, ports 1-4 all had good pH values, but port 8 had a very low pH value. Unfortunately the caps on ports 5, 6, and 7 were stuck and could not be removed for monitoring. Assuming that ports 1-4 are receiving flowing water, this indicates that the water entering in port 8 has much shorter retention time and is likely short-circuiting.

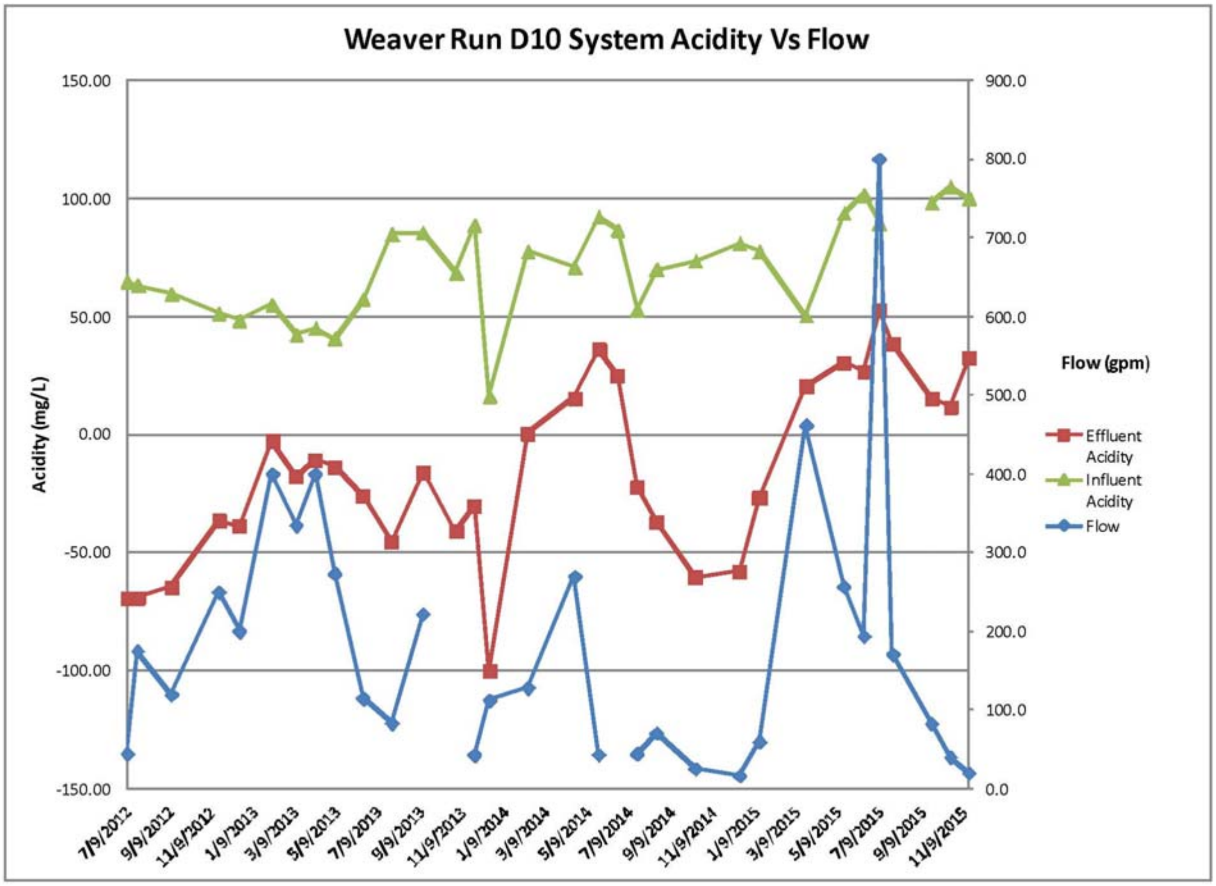
12/17/15 pH values from the Weaver run D10 “Pipe Tree Ports”

Port #	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
pH	*6.71*	*7.22*	*7.11*	*7.03*	*-*	*-*	*-*	*4.89*

A review of the available water quality data for the treatment system was conducted. Upon a closer evaluation of the data, the water monitoring indicates variable treatment over much of the short life of the system. Hot acidity values of the effluent range from -100 to 52 and those samples collected since March 2015 had all been net-acidic, indicating a change in treatment effectiveness. A few additional interesting aspects of the data were observed. A graph of the influent and effluent acidity values compared to flow is provided below. In general, the acidity of the effluent of the system appears to be related to the flow rate. As the flow rate increases, the effluent tends to be more acidic while when the flow rate decreases, the water tends to becomes more net-alkaline. This would tend to make sense as alkalinity generation is closely tied to retention time within the limestone bed. That was until a large flow spike occurred in July 2015. After the flow spike, the flow rate quickly decreases, but the effluent acidity remains high. The extremely high flow event may have caused or enhanced any short-circuiting that was already occurring. Another interesting observation is that towards the second half of 2015, the acidity of the influent AMD tends to be higher, which could also be impacting the overall performance of the system. It is difficult to say whether the higher acidity values are a long-term trend or just a temporary change in water quality due to a disturbance in the mine pool.

In May 2017, BioMost mobilized to conduct maintenance and make improvements to the system with the primary goal of addressing short-circuiting and improving water quality. The concrete level spreader was permanently removed as it was not functioning and would no longer be needed. The limestone bed was stirred over the course of four days to clean sludge and sediment, but more importantly to disrupt pathways that may have developed within the media. Multiple partial flushes were performed to remove sediment from the system while maintaining water within the bed to continue stirring. The stop logs for the water level control structure were lubricated to increase ease of use. During the stirring process, a portion of the limestone was redistributed to fill in and eliminate the inlet pool (aka Forebay). A new perforated inlet distribution pipe with overflow was then installed to evenly distribute the flow across the bed to maximize retention time and improve treatment performance.

In addition to water quality improvements, drainage issues around the site were addressed. A water bar was added to the parking area to direct runoff away from the access road. Parallel to the access road, a drainage ditch was dredged and extended. Potholes in the access road created due to runoff were filled. The condition of the berm was evaluated and appeared to be stable, with vegetation present on most parts of the slopes on site.



A water sample was collected in July 2017 after the maintenance was completed. This was the first sample of the effluent to be measured as net-alkaline since January 2015.

The project team would like to thank the Kiski-Conemaugh StreamTeam, Paint Creek Regional Watershed Association, PA DEP, and the landowners for their support of this much needed maintenance. Funding for technical assistance and maintenance was provided by the PA DEP's Growing Greener grant program and in-kind volunteer services from the watershed association.

Additional Conclusions and Recommendations:

- Periodically measure pH within the pipe tree ports as an indicator of short-circuiting. pH values should be somewhat uniform across the pipes. pH values less than 6 under typical flow conditions may indicate a problem and should prompt further evaluation.
- Currently, there is not a pond for solids to settle or to direct the flush water from the limestone bed. Unless absolutely necessary, it is not recommended to flush to the stream as this partly defeats the purpose of having a treatment system. We recommend that an additional pond be constructed for the purpose of flushing as well as for the settling of metals during normal

operation. Alternatively, it may be possible to utilize filter bags during flushing events, but these are often difficult to use and sometimes are not very effective.

- If flushing must be conducted without using a method to capture the metal solids then it would be best to conduct the flushing during high flow periods or events.
- One option to address difficulties of flushing the pond would be to retro-fit the bed with an Agri Drain solar-powered SmartDrain which can be programmed to flush on a regular basis.
- It has now been a couple of years since the seeps and initial slumping were discovered. More than likely, there is not any significant risk of failing. Fixing the berm would likely be quite expensive and would require seeking a larger grant source. At this point in time, it is recommended to continue to monitor the berm for signs of movement. Installation of a rock drain could be a viable alternative to rebuilding the entire berm.
- The difference in flow measurements between the influent and effluent may simply be due to the difference in how the flow is measured. The influent is measured with a rectangular weir that is not completely level while the effluent is measured using the bucket and stopwatch method with a 10 gallon tote. When using a 10 gallon tote, a 0.1 second difference in time is equal to a measurement difference of 60 gpm. The inaccuracies of both methods could lead to significant differences. There is also the possibility of differences due to time lags associated with the retention time of the system and variable flow rates of the discharge.
- The weir should probably be re-installed to be straight and level.
- Completing a tracer study might help to identify if leakage is occurring.

Dye testing (Top Left and Right) and monitoring at the pipe tree (Bottom Left) indicated that short-circuiting was occurring. The dye test was limited by dye sticking to algae in the forebay (Center and Top Right). During the dye test, a break in the dye (Top Right) indicated where the water was likely entering the stone instead of flowing over the level spreader. Without a settling pond there is no place to settle aluminum solids (Bottom Center) during normal operation or flushing events. A difference is flow measurement techniques and a bent unlevel weir (Bottom Right) may be contributing to discrepancies of flow rather than indicating a leaking pond.

Stone in the limestone bed was stirred (Top Left) to remove metal precipitates coating the stone (Top Center) and disrupt short-circuiting pathways. As the forebay and concrete level spreader were not functioning as intended to distribute flow evenly across the bed, the level spreader was removed and the forebay was filled in with limestone. 12" pipe (Top Right) was perforated and then connected to the inlet pipe to distribute flow evenly across the width of the bed (Bottom).