De Sale Phase 2 Passive Treatment System
SRI O&M TAG Project #22 Request #2
OSM PTS ID: PA-114

Requesting Organization:	Slippery Rock Watershed Coalition
Receiving Stream:	Unnamed Tributary to Seaton Creek
Watershed:	Slippery Rock Creek
Municipality/County:	Venango Twp., Butler Co.
Latitude/Longitude:	41° 8' 40" N / 79° 49' 55" W

The De Sale Phase II Passive Treatment System was constructed in 2000 to treat an entire unnamed tributary, which is impacted by mine drainage from an abandoned surface mine in the headwaters of Seaton Creek in Venango Township, Butler County, PA. The current system was designed by BioMost, Inc., (BMI) and consists of a dam and intake pipe to capture the stream, Forebay, two parallel Vertical Flow Ponds (VFPs), a settling pond, a wetland and a Horizontal Flow Limestone Bed (HFLB). Routine system maintenance and sampling has been conducted by the Slippery Rock Watershed Coalition (SRWC) since system construction.

Previous O&M assistance had been provided under the O&M TAG 1 grant to stir Vertical Flow Pond East (VFPE), as well as cleaning the inlet and outlet of the forebay, clearing the VFP spillway of vegetation, clearing the wetland outlet of vegetation, and re-leveling the HFLB. A new request for maintenance was received by the SRWC in September 2014. Over the winter of 2013/2014, leaves, sticks and other debris had clogged the bar guard of the forebay pipe which splits flow between the two Vertical Flow Ponds. Ice built up quickly and water began to flow over the emergency spillway, bypassing the treatment system. In addition, volunteers had complained that the inlet of the pipe and bar guard were too far out in the pond to easily and safely clean. A plan was developed to address these issues.

In December 2014, maintenance was conducted. The inlet side of the 10” forebay pipe was cut so that it would be easier to reach from the side of the pond and a 10” tee was installed to help prevent clogging and provide two different points of entry. The 8” flexible couplers (Ferncos) and 8” elbows that were used to balance the flow from the Forebay to the two VFPs were replaced with 8” x 6” reducers fitted with 6” shielded Ferncos and 6” 90-degree elbows to reduce the effort needed to adjust the flow. The emergency spillway of the Forebay was relocated to direct any future overflow events into VFPE instead of bypassing the water to the stream.

Before performing those modifications, water quality monitoring was conducted at both VFP outlets (8 pipes per VFP) and the wetland outlet. Each VFP pipe that was flowing was sampled individually to assess functionality of each cell. The VFPE upper tier of pipes had poor water quality, and the lower tier of pipes had better water quality. It is possible that during previous O&M activities, the upper tier of pipes had been compromised, which allowed short circuiting to occur, although the fact that the pipes are located near the top of the media does reduce residence time. The VFPW pipes were also sampled, and it was determined that stirring the pond would be beneficial to improve water quality of the effluent pipes.

Both VFPs were backflushed (8 pipes per VFP) using an excavator to power a 6" hydraulic-drive pump in an effort to clear the area surrounding the underdrain pipes from any materials which may have been preventing flow to the pipes. The VFP outlet riser pipes were capped during this process to allow sufficient pressure for the backflushing process. These caps were later removed from the lower tier of pipes and the outlet risers were reinstalled. Pressure from the backflushing process was high enough that some of the pipes connecting to the outlet valves were loosened. Those pipes were re-connected as needed. Visual inspection of both ponds were conducted during the backflushing activities for each pipe, but very little was able to be discerned due to a 1"+ layer of ice on both ponds. A plume of iron was noted under the ice upon flushing pipe #5, which is one of the upper tier pipes in VFPW. Water levels within both ponds rose noticeably during backflushing.

After backflushing the VFP pipes, VFPW was drained and the upper 3-4 feet of media within the pond was stirred. The media within the pond was originally layered with spent mushroom compost on top of a limestone layer, with a two-tiered perforated underdrain piping system. By stirring the mushroom compost into the limestone layer, a more uniform distribution of flow should develop. Previously, "rat holes" where water would short-circuit within the pond would develop and cause poor treatment performance. An access ramp was also constructed which was left in place for future maintenance activities.

As the upper tier of pipes have historically had poorer water quality especially during high flow events, a decision was made to leave the outlet risers of the upper tier of both VFPs capped. However, the upper tiers of both ponds are functional and can still be utilized for flushing.

Select water monitoring data of the effluent pipes of the VFPs conducted during O&M TAG 1 and 2 projects are provided in the table below. Comparison of the data from different dates is difficult because of the varying flow rates. Flow rates of 12/8/14, and 12/11/14 are much lower than those on 12/11/12 and 5/7/15. However, a comparison of final effluent data from the HFLB (available on Datashed) indicates that the 5/17/15 sample at 190 gpm was one of the best water quality dates ever sampled during the previous 14 years even though it was one the third largest flow rate measured at the HFLB.

VFPE and VFPW Effluent Pipe Monitoring Pre- and Post- Maintenance

Date	Parameter	VFPW								VFPE							
	Pipe #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
12/11/12	pH	NA	NA	NA	3.9	6.4	6.2	6.2	6.2	6.3	6.3	6.2	6.2	6.2	6.1	5.8	5.3
	Alkalinity	NA	NA	NA	0	41	16	15	18	42	32	36	38	37	27	14	3
	Flow	0	0	0	3	36	55	48	50	60	60	60	36	5.1	12	23	8
12/8/14	pH	NA	NA	NA	NA	6.2	5.8	6.0	6.5	7.2	7.2	7.2	7.1	4.4	5.1	5.8	4.4
	Alkalinity	NA	NA	NA	NA	6	3	5	9	102	94	86	86	0	NM	NM	0
	Flow	0	0	0	0	7	7	8	9	7	6	6	5	4	1	1	5
12/11/14	pH	NA	NA	NA	NA	5.7	5.3	5.6	6.3	7.2	7.1	7.0	6.9	3.5	4.1	5.4	3.9
	Alkalinity	NA	NA	NA	NA	3	1	1	25	92	87	85	84	NA	NA	3	NA
	Flow	0	0	0	0	5	9	8	7	7	6	5	4	2	1	1	6
5/7/15	pH	NA	NA	NA	NA	5.9	5.7	5.8	5.7	6.3	6.3	6.2	6.3	NA	NA	NA	NA
	Alkalinity	NA	NA	NA	NA	33				91				NA	NA	NA	NA
	Flow	NA	NA	NA	NA	30	33	34	33	16	17	13	16	NA	NA	NA	NA

Flow in gallons per minute (gpm); pH standard units; alkalinity in mg/L

The project team would like to thank the SRWC for their support and assistance with this project, and the PA DEP Growing Greener program for providing the funding to make this much needed maintenance activity possible.

Top Left: The bar guard on the Forebay effluent pipe was difficult to clean because of the length of the pipe that extended into the pond.
Top Right: Effluent pipe was shortened and a tee with bar guard on top was added to provide two points of entry.
Bottom Left: Water monitoring was conducted and a decision was made to backflush all of the VFP pipes, making it necessary to temporarily cap the outlet pipes.
Bottom Right: The top 3-4 feet of treatment media within VFPW was stirred.