

**BROAD TOP TOWNSHIP**

**187 MUNICIPAL ROAD - PO BOX 57**

**DEFIANCE, PA 16633**

**814-928-5253**

**FINAL REPORT**

**FOR PADEP**

**NONPOINT SOURCE SECTION 319 FUNDS**

**GRANT ME# 4100064394**

**SIX MILE RUN – SX0-D9**

**AMD CONSTRUCTION PROJECT**

**May 18 2017**



## **TECHNICAL REPORT**

The Six Mile Run watershed is located in Broad Top Township in the northeastern corner of Bedford County. From its headwaters to its confluence with the Raystown Branch of the Juniata River, the watershed is partially forested with several residences along the mainstem in the towns of Coaldale and Defiance. Six Mile Run is classified as a warm water fishery (WWF).

The impacts of abandoned underground and surface coalmines have severely impaired the water quality and aquatic life communities in Six Mile Run. Old mining operations have resulted in at least 30 different identified abandoned mine drainage (AMD) sites in the Six Mile Run watershed. The AMD discharges in the watershed lower the naturally low pH and produce elevated dissolved metals concentrations in Six Mile Run. Six Mile Run is listed as impaired on the Pennsylvania Department of Environmental Protection's (PA DEP) 303(d) list. A 6.16-mile segment where Shreeves Run enters Six Mile Run is listed as impaired on Pennsylvania Department of Environmental Protection's (PA DEP) 303(d) list for both pH and metals as a result of the AMD discharges. Several significant AMD discharges along the mainstem of Six Mile Run were identified in the 2001 AMD Assessment and Remediation Plan. The SX0-D9 AMD discharge was identified in this plan as a significant discharge to the mainstem of Six Mile Run and as a top priority for remediation. Therefore, the SX0-D9 AMD discharge was targeted for passive treatment to increase pH, provide excess alkalinity, and reduce metals loading, specifically iron and aluminum in order to restore the water quality in Six Mile Run. The Six Mile Run SX0-D9 AMD remediation project was the next step in helping to restore Six Mile Run, specifically the headwaters of the mainstem. The SX0-D9 AMD discharge is net acidic, with high aluminum and iron concentrations. This AMD discharge annually contributes 2.76 tons or 11% of the iron load, 1.6 ton or 4% of the aluminum load and 16.4 tons or 4% of the acidity load to Six Mile Run.

Broad Top Township received PA DEP Section 319 Grant funding for the construction of a passive treatment system at this high priority AMD discharge site. Skelly and Loy, Inc. completed the preliminary engineering design work through a U.S. Army Corps of Engineers project for remediation of multiple AMD sources in the lower portion of Six Mile Run. Broad Top Township selected Skelly and Loy, Inc. to prepare the final engineering design and permitting of the passive treatment system for an estimated 20 to 25-year life. The treatment system engineering design was completed in 2013 and construction was completed in the summer of 2014, following receipt of all the necessary permitting approvals. Based on data from the 2001 AMD Assessment and Remediation Plan and topographic survey information for the site collected by Young's Surveying, Inc. personnel, the project team selected a limestone pond

passive treatment system for capture and treatment of the AMD discharge at the site. The SX0-D9 discharge is located above the north bank of Six Mile Run at the west end of the village of Defiance with a large open and relatively flat area adjacent to the discharge site in a westward direction towards Six Mile Run that was used for installing a passive treatment system. Passive treatment of the SX0-D9 discharge utilizing the existing natural iron terrace feature to reduce iron concentrations prior to treatment in the limestone pond followed by a settling pond with an aerobic wetland at the end of the system for final polishing based on the water chemistry. Township personnel & equipment performed the construction. This project included construction of a limestone pond, a settling pond, and an aerobic wetland for treatment while using the existing iron terrace for pre-treatment. The design provides for at least a 90% percent reduction in the iron, aluminum and acidity pollution from this discharge.

The iron present in the AMD was determined to be primarily in the ferrous iron form ( $Fe^{2+}$ ), indicating a lack of dissolved oxygen in the AMD as it flows from the source. Based on the flow rate, projected alkalinity generation rate (100 mg/L), and a 25-year design life, approximately 2,500 tons of limestone was used for the 190ft x 75ft limestone pond and a solar powered automatic flushing system was installed in the limestone pond to remove aluminum and iron precipitates from the void spaces in the limestone. Baffles were installed within the 120ft x 65ft settling pond and the 170ft x 50ft aerobic wetland to help settle, retain, and accumulate the metal precipitates formed during the limestone treatment and subsequent increase in pH of the AMD discharge. Before treatment the AMD discharge was characterized as follows:

**SX0-D9 Raw AMD Discharges Characterization**

<b>SITE</b>	<b>FLOW (gpm)</b>	<b>pH (SU)</b>	<b>ALKALINITY (mg/L)</b>	<b>ACIDITY (mg/L)</b>	<b>TOTAL IRON (mg/L)</b>	<b>TOTAL ALUMINUM (mg/L)</b>	
<b>SX0-D9</b>	45	3.8	0	146	38	12	

**SX0-D9 After treatment AMD Discharges Characterization**

<b>SITE</b>	<b>FLOW (gpm)</b>	<b>pH (SU)</b>	<b>ALKALINITY (mg/L)</b>	<b>ACIDITY (mg/L)</b>	<b>TOTAL IRON (mg/L)</b>	<b>TOTAL ALUMINUM (mg/L)</b>	
<b>SX0-D9</b>	60	7.5	109	-83	0.31	0.49	

The source of this discharge or seep is an old underground mine on the northern portion of the site, which had a buried entry in the area of the discharge. The system included a vertical flow wetland, a settling pond, a limestone pond and an aerobic wetland for treatment. An extensive perforated piping network was used below the top of the limestone layer and attached to an automatic inline water level control structure for automatic flushing purposes and a basic perforated piping network located near the bottom of the limestone layer was used and attached to an inline water level control structure for both normal outflow and flushing purposes. The water is then directed out of the FLB and into a settling pond where the metal precipitates are settled and retained. The final component of the passive treatment system is an aerobic wetland, which will help to settle and retain the metal precipitates. An inlet water level control structure was specified in the settling pond to control the water level and provide a means of draining the pond for any necessary maintenance.

An automatic inline water level control structure and perforated piping network was used to set the water level in the FLB and to flush the aluminum and iron precipitates to the settling pond. The automatic inline water level control structure allows the programming of the unit to periodically flush the FLB at specified frequency. The settling pond was constructed following the FLB for the purpose of metal precipitate removal. A baffle was utilized in the settling pond to reduce velocities of the incoming water and to encourage settling of the metal precipitates. An inlet water level control structure was utilized in the settling pond to allow for adjustment of the water elevation for adequate retention in the settling pond. The inlet structure also allows for dewatering of the pond for maintenance purposes (e.g., sludge removal). The outfall from the aerobic wetland serves as the final discharge that eventually leads down to the mainstem of Six Mile Run.

## **PROJECT RESULTS**

The AMD discharge proposed for treatment in this project was historically a significant loading source of acidity, iron, and aluminum to Six Mile Run. This project resulted in the construction of a passive AMD treatment system that is expected to have a 90% percent reduction in the iron, aluminum and acidity pollution from this discharge. Initial testing of the system shows a reduction of 79.2 lbs/day acidity, 20.4 lbs/day of iron and 6.2 lbs/day of aluminum supports this expectation. The outcome of this project in conjunction with other funded projects along the mainstem of Six Mile Run in a downstream remediation approach should provide for significant restoration in the upstream half of Six Mile Run with regards to AMD degradation.

## **OPERATION & MAINTENANCE**

Skelly and Loy has prepared an Operation and Maintenance (O&M) Manual for the passive treatment system and Broad Top Township has committed to perform the routine O&M required to keep this system functioning during the projected 20 to 25-year life.

The general O&M requirements for this system includes quarterly inspections with field testing of flow and pH to ensure it is operating properly, flushing of FLB on a quarterly basis (at a minimum), keeping all channels and pipes clear for both regular and high flows, repairs of any erosion, sludge removal from the pre-treatment/settling pond and settling pond as necessary, potentially stirring up of the upper limestone layer in the FLB to help preserve the open pore space from the accumulation of aluminum.

## **CONCLUSION**

The passive treatment system for the SX0-D9 AMD discharge was constructed using funding from the PA DEP Section 319 program. Broad Top Township will continue to obtain Section 319 funding grants to design/construct treatment systems as part of a larger effort to restore the Six Mile, Sandy Run, and Longs Run watersheds as identified in the 2001 AMD

## Assessment and Remediation Plan.

Construction of this passive AMD treatment system has reduced acidity and metals concentrations discharging to the mainstem of Six Mile Run and provides a significant contaminant load reduction to the lower section of Six Mile Run. The construction of this project as provided in the grant is complete. The combined results of this project along with the recently completed upstream SX8-D1, SX0-D8 and SX0-D6 remediation projects, are anticipated to help achieve the pH and metals reductions required by the TMDL set by PA DEP for Six Mile Run. Natural aquatic life is starting to return to the middle & upper sections of Six Mile Run and will continue to do so as more AMD remediation work is completed in the Six Mile Run watershed.

### **REFERENCES**

1. Six Mile, Sandy and Longs Run Watersheds AMD Assessment and Remediation Plan - 2001
2. Six Mile Run Watershed Final TMDL Report- 2002

### **APPENDICES**

- A. PROJECT LOCATION MAP
- B. PROJECT PICTURES
- C. AS-BUILT