BLACKLEGGS CREEK WATERSHED ASSOCIATION
POST OFFICE BOX 59
CLARKSBURG, PENNSYLVANIA 15725-0059
724-639-3002

FINAL REPORT
FOR U.S. EPA
SECTION 319 GRANT

BIG RUN AMD REMEDIATION PROJECT
PHASE II

NOVEMBER 2007
REV. 1

TABLE OF CONTENTS

TECHNICAL REPORT

TECHNICAL REPORT

The target section of Big Run watershed, which is a tributary to Blackleggs Creek watershed, is located in Conemaugh Township in Indiana County. Big Run is classified as a coldwater fishery (CWF) according to Pennsylvania Code Chapter 93 Water Quality Standards. Just east of Clarksburg, Big Run joins Blackleggs Creek at the intersection of Sportsman Road (T-304), which enters the Kiskiminetes River. Big Run is the largest contributor of acid mine drainage (AMD) to the Blackleggs Creek watershed, which creates a problem since the best habitat for trout in Blacklegs Creek is downstream of the Big Run confluence.

The impacts of abandoned underground and surface coal mines have severely impaired the aquatic life in Big Run. Big Run watershed is drastically degraded by AMD from four primary sources, referred to as Big Run #2, #3, #7, and #8 discharges. The Big Run #2 project was funded, and construction and improvements were completed in 2007 to remediate this discharge. This Phase II project involved the remediation of the Big Run #7 discharge and developing a conceptual plan for the Big Run #8 discharge, which is the largest AMD contributor to Big Run. The AMD discharges lower the pH and produce elevated dissolved metals concentrations in Big Run. Big Run is listed as impaired on the Pennsylvania Department of Environmental Protection's (PA DEP) 303(d) list, for both pH and metals as a result of the AMD discharges. A TMDL has not been developed for Big Run to address the existing level of impairment. Using the same concept as employed for the Big Run #2 and #7 discharges, passive treatment using limestone-based systems are proposed for the remaining two AMD discharges to Big Run. The goal of the limestone-based passive treatment is to increase pH, provide excess alkalinity, and reduce metals loading, specifically aluminum and iron in order to restore the water quality in Big Run. The Big Run #7 AMD discharge for this project is net acidic, with moderate to high aluminum concentrations and low iron concentrations. Overall, the Big Run #7 discharge contributes approximately 26 tons of aluminum and 275 tons of acidity annually to Big Run. The Big Run #8 AMD discharge for this project is net acidic, with high aluminum concentrations and moderate to high iron concentrations. Overall, the Big Run #8 discharge contributes approximately 57 tons of aluminum, 33 tons of iron, and 584 tons of acidity annually to Big Run.

Blackleggs Creek Watershed Association (BCWA) received U.S. Environmental Protection Agency (EPA) Section 319 Grant funding for the design and construction of the Big Run #7 passive AMD treatment system and investigation and conceptual treatment ideas for the Big Run #8 discharge. BCWA selected Skelly and Loy, Inc. to design the Big Run #7 passive treatment system(s) for an estimated 20- to 25-year life and to supervise the construction. In addition, Skelly and Loy was contracted by BCWA to perform the investigation and conceptual design for the Big Run #8 discharge. Based on the historic water quality and flow data collected by The Stream Team, site surveys were collected and prepared, while Skelly and Loy evaluated alternatives for capturing and treating the Big Run #7 AMD discharge at the site. Essentially, one elaborate passive treatment system was proposed and constructed for treating the discharge with the final polishing wetland located on the opposite side of Sportsman Road (T-304) having the potential to receive future treatment system outfalls from Big Run #3 and #8. The Big Run #7 passive AMD treatment system incorporated a large limestone pond type system and settling pond, with a final polishing wetland. The design for the passive treatment system(s) included the determination of the configurations of limestone and settling ponds and polishing wetland for routing and treating the discharges based on site topography and the characteristics of the discharge.

As part of the investigation and development of the design for both the Big Run #7 and #8 (conceptual) AMD discharges, drilling was conducted to serve three purposes. First, the drilling was needed to determine the extent of the coal seam that may be recoverable in the area around the Big Run #7 discharge. Second was the need to determine the availability of suitable clay around the site. Finally, drilling was needed to determine the presence of rock that may be too solid to excavate for constructing treatment ponds. The results of the drilling effort were documented in a drill log that is included in Appendix C. In addition to the results of the drilling effort funded through this grant, data obtained from laboratory bench-scale testing conducted by Skelly and Loy as part of the Big Run #8 design effort funded by Norfolk Southern were considered in developing the conceptual design for the Big Run #8 treatment system.

In the limestone pond at the Big Run #7 site, the AMD discharge passes through the high calcium carbonate limestone (typically greater than 80% $CaCO_3$) and dissolves the limestone to impart alkalinity and neutralize acidity. The net alkaline water is then routed into the settling or retention pond for precipitation of the metals, primarily aluminum. Skelly and Loy designed a manual flushing system using an inline water level control structure and extensive piping network to aid in the removal of primarily aluminum precipitates from the void spaces in the limestone. A second inline water level control structure was designed and implemented to serve as the normal flow course for the AMD to outfall from the limestone pond. Before treatment, the AMD discharge is characterized as follows.

Big Run #7 Raw AMD Discharge Characterization

AVG FLOW (GPM)	PH (SU)	ALKALINITY (MG/L)	ACIDITY (MG/L)	TOTAL IRON (MG/L)	TOTAL ALUMINUM (MG/L)	TOTAL MANGANESE (MG/L)
790	3.4	0	159	< 2.0	15.0	2.6

The most essential aspect of the design for the Big Run #8 AMD discharge lies in delivering the discharge water to the treatment location. The discharge presently emanates from a drainage heading blasted approximately 1,040 feet horizontally through bedrock from the stream elevation back into a low point in the mine. The proposed treatment strategy involves constructing a controlled mine seal in the drainage heading that would allow for water to be directed to a large limestone pond or directly to Big Run. The mine seal will take place at the discharge location along Big Run and will involve installation of a manual control valve. The valve will allow the water elevation in the mine pool to be raised in a controlled, gradual manner. Mine maps indicate that the discharge will flow out of the mine through a drift entry once the pool has been raised to an elevation of 1,026 feet. Exploratory drilling has been conducted and the drainage heading located in the proposed area of mine seal construction. A conceptual design drawing is included in Appendix A.

The conceptual design for the Big Run #8 AMD treatment system provided an innovative approach to semi-passively remediate the discharge. While the capture system for the discharge presented a significant challenge due to the mine pool elevations compared to the tunnel discharge, the conceptual plan for treatment involved the use of limestone, settling, and a new innovative material known as ECOTITE™ mixed with compost. The ECOTITE™ material is a fine aggregate material with scientifically-studied properties that enable it to generate alkalinity and adsorb dissolved metals from water. A limestone pond is proposed for the Big Run #8 treatment system design to provide a short contact time with a large settling pond following to capture and settle out any precipitated metals. Finally, the conceptual design calls for a final polishing/treatment pond using ECOTITE™ material mixed with compost which showed promise in treating the Big Run #8 discharge during the laboratory testing. After the ECOTITE™ and compost treatment pond, the treated water will be directed under Sportsman Road as the final outfall to Big Run. Following capture of the AMD through the sophisticated mine seal and riser structures, the limestone pond will accept the Big Run #8 discharge, up to approximately 2,000 gallons per minute (gpm), contact the water with high calcium carbonate limestone, and direct the water to a large settling pond. Following the settling pond, the water will be directed through another large pond containing the ECOTITE™ and compost mixture to add additional alkalinity and remove the remaining dissolved metals. A summary of the Big Run #8 discharge water quality, flow rates, and design assumptions is as follows.

Big Run #8	
Average Flow Rate	898 GPM
Maximum Design Flow Rate	2,000 GPM
Average pH	3.3 S.U.
Average Acidity	301 mg/L
Average Iron	9.2 mg/L
Average Aluminum	23.3 mg/L

BIG RUN #7

The source of this discharge is an old underground mine with an exposed entry. This AMD discharge is characterized as highly variable with respect to flow rate and has historically reached rates nearing 2,000 gpm. A mine seal was constructed in the mine opening to allow for the backing of water in the mine and provide a controlled feed mechanism into the treatment system through an inline water level control structure. This inflow structure should promote a more stable and consistent flow entering the limestone pond that is manually controlled. The passive treatment system was designed to treat the discharge with a limestone pond for alkalinity generation followed by a settling pond for detention of the treated water to capture the aluminum precipitates. The limestone pond contains approximately 3,900 tons of limestone in a four-foot deep layer. An extensive piping network was installed to aid in flushing accumulated aluminum precipitates from the void spaces in the limestone using a manually controlled inline structure. This piping network and inline structure is strictly used for flushing purposes and through the adjustment of stop logs within the structure the flush may be directed to either the settling pond or the proposed polishing pond for Big Run #3 on the opposite side of Sportsman Road. Normal flows through the limestone pond exit the system through a single perforated pipe at the downstream end of the pond and outlet through an inline structure into the settling pond. The water directed into the settling pond for metals settling and retention, specifically aluminum. The water is then directed out of the settling pond and underneath Sportsman Road, where it currently is routed to Big Run. However, as part of the proposed Big Run #3 project, the settling pond outfall would be directed into a final polishing pond prior to final discharge to Big Run to provide tertiary treatment of the AMD. An as-built drawing for the Big Run #7 passive AMD treatment system is included with this report in Appendix A.

Based on the flow and water chemistry, it was calculated that the amount of limestone used in the limestone pond would produce enough alkalinity to raise the pH and precipitate the dissolved aluminum from the Big Run #7 discharge. With a design flow rate of 1,826 gpm, the limestone contact time is estimated at 5 hours with the initial quantity of limestone. At the average flow rate of approximately 800 gpm, the limestone contact time is approximately 12 hours. The settling pond provides the retention and capacity to receive the limestone pond outfall to settle and retain the aluminum precipitates. At the maximum design flow, the settling pond is estimated to provide approximately 4 hours of retention, while at the average flow rate the retention time is nearly 9 hours. An inlet water level control structure was installed in the settling pond to control the water level and provide a means of draining the pond for any necessary maintenance. Additionally, two floating vinyl baffles were installed perpendicular to flow in the settling pond to aid in settling the aluminum precipitates. The proposed final polishing pond as part of the Big Run #3 project, currently applied for through the Pennsylvania Growing Greener program (2007), would provide additional retention time above and beyond the retention times provided in the Big Run #7 settling pond.

An inline water level control structure (inline structure #2) is used to set the water level in the limestone pond, while inline structure #3 is primarily used to manually flush the aluminum precipitates from the void spaces in the limestone to the settling pond. Inline structure #3, located in the limestone bed, is hydraulically connected to a network of solid and perforated PVC pipe near the upstream end of the limestone pond. The settling pond was constructed following the limestone pond using the available space for the purpose of metal precipitate removal using detention time and settling mechanisms. The inlet water level control structure was installed in the settling pond to allow for adjustment of the water elevation for adequate retention in the settling pond in response to sediment and/or metals accumulation. The inlet structure also allows for dewatering of the pond for maintenance purposes (e.g., sludge removal). The outfall from the settling pond inlet structure is directed underneath Sportsman Road through a new culvert and into a channel, which serves as the final discharge that eventually leads down to Big Run. Testing (see below) shows that the passive treatment system is neutralizing most of the acidity and removing most of the dissolved aluminum from the Big Run #7 discharge, despite the observance of significantly higher flow rates from this AMD discharge. A majority of the project construction was completed near the end of 2006, but additional work on the mine seal was not completed until the Spring/Summer of 2007.

BIG RUN #8

The Big Run #8 discharge directly enters Big Run from a large pipe that drains the underground mine pool, believed to be separate from the Big Run #7 mine pool. This AMD discharge contains moderate to high concentrations of iron and aluminum and high levels of acidity. The flow rates are similar to Big Run #7, which has also shown higher flow rates over the course of this project compared to historical data. For this reason, a separate extensive treatment system is proposed for this discharge as well as an elaborate capture system in order to collect and divert the discharge, which is contained within a pipe approximately 30 or more feet below the existing surface on the site. The existing pipe that was installed at the lowest point in the mine pool, currently drains the underground mine pool and runs under Sportsman Road and discharges directly to Big Run. This AMD discharge is one of the most significant sources of AMD pollutants to Big Run and probably one of the most difficult to provide treatment.

The conceptual design plan calls for the alkalinity generation of the Big Run #8 discharge to be accomplished through the use of a large limestone-containing ponds totaling 4,800 tons of limestone and a second treatment cell containing a mixture of ECOTITE™ and compost materials. Following the initial alkalinity generation pond (containing limestone), a settling pond is proposed to settle out the metal precipitates, primarily aluminum and some iron, to help prevent those precipitates from clogging the ECOTITE™ and compost and impacting treatment efficiency. The limestone pond, located at the proposed capture point, contains approximately 4,800 tons of limestone in a 5-foot deep layer. The second treatment pond, containing approximately 1,000 tons of ECOTITE™ and 835 cubic yards of spent mushroom compost in a 3-foot layer, is proposed immediately following the settling pond. Following the ECOTITE™ and compost treatment pond, the water is directed under Sportsman Road into an existing swale that outfalls into Big Run. However, the option will exist for the final discharge to be directed into a final polishing pond, proposed as part of the Big Run #3 treatment system, where it would combine with the Big Run #3 and Big Run #7 final treatment system discharges. The final polishing pond is intended for final polishing and metal precipitate settling and retention prior to final discharge to Big Run.

Multiple inline water level control structures were included in the conceptual design to manually remove aluminum and iron precipitates from the void spaces in the limestone pond. The limestone pond is designed with four different inline structures, three proposed for flushing purposes and the fourth would serve as the water level control structure and primary outlet structure into the settling pond. Each inline structure proposed for the limestone pond is hydraulically connected to the limestone pond by a series of solid and perforated PVC pipes within the limestone bed. The outlet pipes from the three inline structures proposed for manual flushing events are connected to one main pipe that would convey the flushed water and precipitates down to the final polishing pond from the proposed Big Run #3 project. The settling pond following the limestone pond is proposed to settle and retain the metal precipitates from the initial alkalinity treatment in the limestone pond, which is expected to be primarily aluminum and some oxidized ferric iron. Two inlet water level control structures would serve as the outlet structures for the settling pond to help manually control the water level and retention time and to drain the pond as needed for maintenance. From the settling pond the water is directed through a piping network and into the ECOTITE™ and compost treatment pond for additional alkalinity generation and metals removal. An inlet structure would serve as the water level and outlet structure for the treatment pond containing the ECOTITE™ and compost materials. This inlet structure would also allow the treatment pond to be completely drained in order to perform any maintenance on the bed of materials as needed. Finally, the outfall from ECOTITE™ and compost treatment pond would be directed underneath Sportsman Road to the existing swale down to Big Run or the final polishing pond that is proposed for the Big Run #3 AMD treatment system. If funded and constructed this would provide the final phase of treatment for the Big Run #8 discharge before entering Big Run.

The limestone pond is anticipated to serve as a pre-treatment cell for the Big Run #8 AMD discharge to try and remove some of the aluminum and easily oxidized ferric iron prior to the final alkalinity and metals removal step in the ECOTITE™ and compost treatment pond. The settling pond will help to polish the water by removing any suspended solids or precipitates prior to entering the final treatment pond, which works more efficiently and longer when it receives low turbidity water. The limestone and ECOTITE™/compost mixture are proposed for the alkalinity treatment of Big Run #8 because of their ease of maintenance and ability to replenish the materials as needed in the future. The ECOTITE™ material would require off-site disposal when the treatment capacity is spent, which is easily accomplished with some equipment and haul trucks.

Currently, the Big Run #8 AMD treatment system is being constructed by a contractor hired by the BCWA through funding provided by Norfolk Southern as part of a mitigation plan/ agreement. Completion of this project construction is expected by the Spring of 2008 and should provide a significant level of AMD contaminant load reduction to Big Run, specifically aluminum, iron, and acidity. The conceptual design created as part of the U.S. EPA Section 319 Grant project was instrumental in developing the final design and construction plan for the Big Run #8 treatment system and provided vital information necessary to understand the source of the AMD and the project site.

PROJECT RESULTS

PROJECT RESULTS

The Big Run #7 AMD discharge treated in this project was historically a significant loading source of acidity and aluminum to Big Run and ultimately Blackleggs Creek. During a sampling event on October 21, 2006, samples for water chemistry measurements were collected from the final outfall of the constructed passive treatment system to evaluate the performance. System performance was evaluated by comparing pH, acidity, alkalinity and metal concentrations of the historical raw untreated AMD and the final treated discharge from the constructed passive treatment system.

STATION	FLOW (GPM)	PH	ALKALINITY (MG/L)	ACIDITY (MG/L)	TOTAL ALUMINUM (MG/L)
Big Run #7 Raw (Historical Avg.)	1580	3.37	0	166.6	17.88
Final Outfall – 10/21/06	N.M.	7.60	201	-180	<0.50

Based on this sampling event and some follow-up measurements of the outfall pH, the Big Run #7 treatment system is performing pretty well, but because of the high flows ever since the system has been constructed in 2006-2007, the outfall may show the presence of some acidity associated with any remaining aluminum or iron levels in the final discharge. The recent installation of the floating vinyl baffles in the settling pond will assist in keeping most of the precipitated aluminum in the treatment system. The treatment system is typically achieving the design effluent concentrations for aluminum and acidity, showing nearly 100% removal of both parameters in the final outfall. Under normal flow conditions, the alkalinity production rate and aluminum removal should be sufficient to create a net alkaline effluent with anticipated low aluminum concentrations in the passive AMD treatment system final outfall. The entire Big Run #7 discharge was not permanently diverted into the constructed passive treatment system until late 2007 because of the continued work on the mine seal at the two mine openings. Because of this delay in permanently diverting the discharge into the treatment system, it was difficult to obtain much information on system effectiveness and improvements downstream in Big Run.

OPERATION AND MAINTENANCE

OPERATION AND MAINTENANCE

An Operation and Maintenance (O&M) Manual for the Big Run #7 passive treatment system constructed with this grant funding will be developed and included on the as-built drawing (see Appendix A). BCWA has committed to perform the routine O&M required to keep these systems functioning during their projected 20- to 25-year life. BCWA has currently not obtained the funds that will be required to perform the annual O&M and refurbish this treatment system at the end of its initial life.

The general O&M requirements for this system includes quarterly inspections with field testing of flow and pH to ensure the treatment system is operating properly, periodic manual flushing of the limestone ponds at intervals based on the needs of the system, keeping all channels clear for both regular and high flows, repairs of any erosion, sludge removal from the settling pond as necessary, and potentially stirring up the stone in the limestone pond to help preserve the open pore space from the accumulation of aluminum and the removal of metal precipitates from the settling ponds. Water chemistry samples shall be collected at least twice a year for both the raw AMD and final system outfall to monitor the treatment system effectiveness and help to determine the need for any maintenance activities such as flushing or stirring of the limestone bed and sludge removed from the settling pond. Refer to the O&M notes on the as-built drawing for the Big Run #7 project in Appendix A.

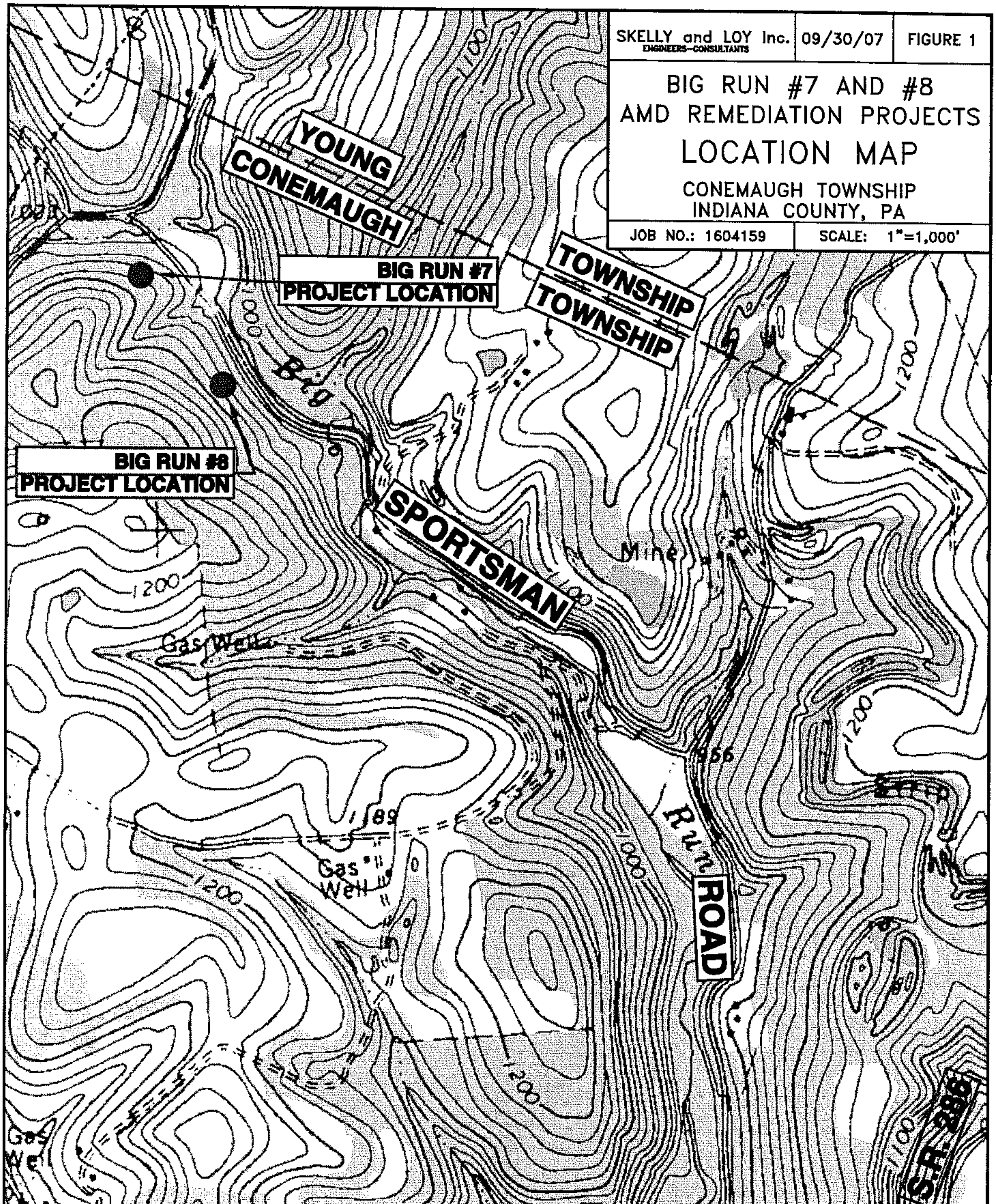
CONCLUSION

CONCLUSION

The Big Run #7 AMD passive treatment system was constructed in 2006 and 2007 using funding from the U.S. EPA Section 319 Grant program. A local contractor hired by BCWA constructed the system as part of a larger effort to restore the Blackleggs Creek watershed. The construction of the passive AMD treatment system has significantly reduced acidity and metals concentrations discharging directly to Big Run and provided a significant contaminant load reduction to the upper section of Big Run. This project is complete with the exception of the continued operation and maintenance requirements outlined above, which are projected to continue indefinitely. The combined results of this project along with the recently completed Big Run #2 Project, current construction work at the Big Run #8 site, and proposed work at the Big Run #3 site that would result in the construction of four passive AMD treatment systems in a section along the mainstem of Big Run are anticipated to achieve the pH and metals reductions needed to restore the Blackleggs Creek watershed. Aquatic life is expected to start returning to this tributary stream and within the watershed and will continue to do so as more AMD remediation work is completed in Big Run.

APPENDICES

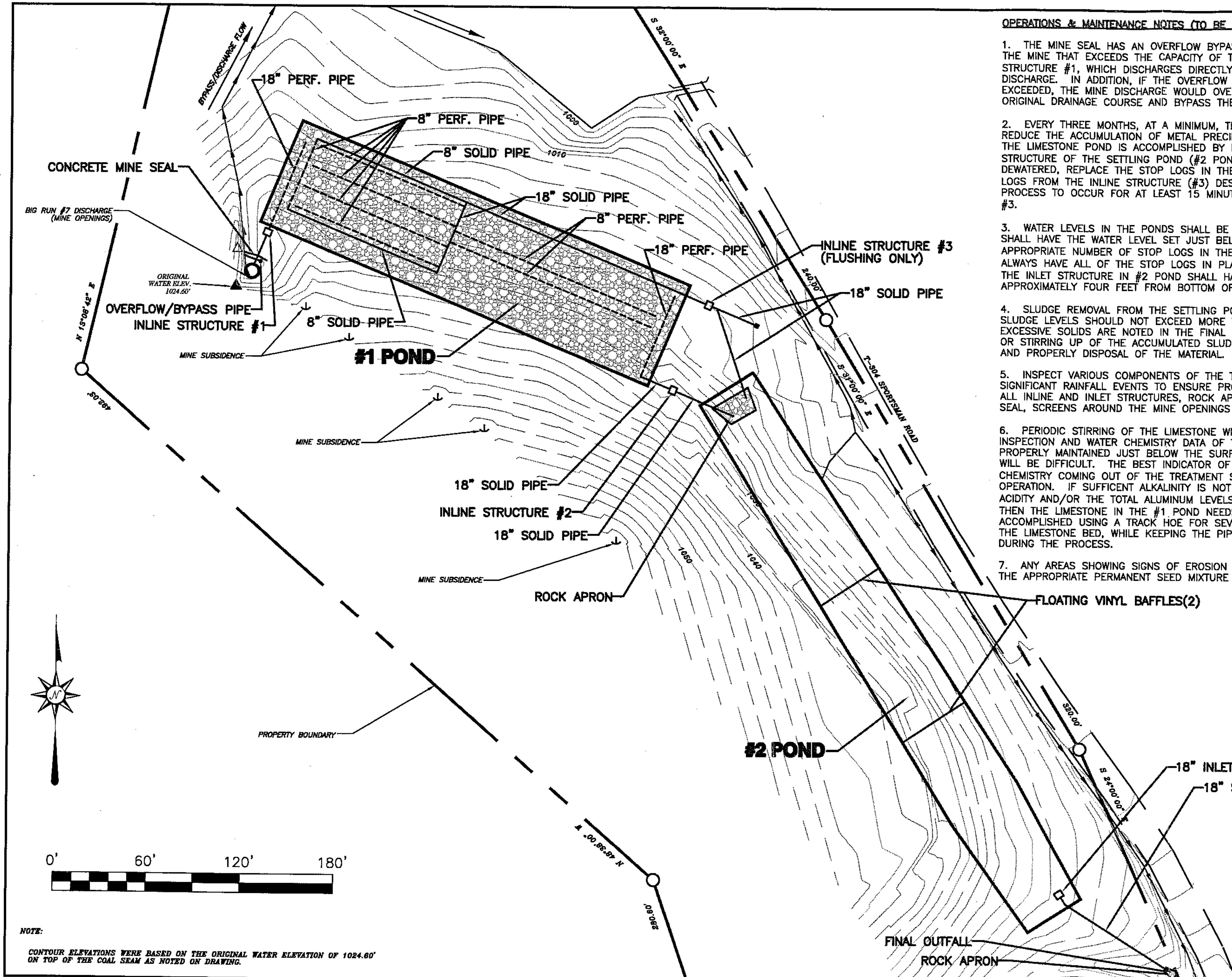
APPENDIX A -
PROJECT LOCATION MAP, AS-BUILT DRAWING (BIG RUN #7), AND CONCEPT DESIGN DRAWING (BIG RUN #8)



LOCATION MAP

SCALE: 1"=1,000'

SOURCE: AVONMORE, PA USGS 7.5' QUADRANGLE



NOTE:

CONTOUR ELEVATIONS WERE BASED ON THE ORIGINAL WATER ELEVATION OF 1024.60' ON TOP OF THE COAL SEAM AS NOTED ON DRAWING.

OPERATIONS & MAINTENANCE NOTES (TO BE PERFORMED BY BCWA):

1. THE MINE SEAL HAS AN OVERFLOW BYPASS PIPE THAT SHOULD HANDLE ANY EXCESS FLOWS FROM THE MINE THAT EXCEEDS THE CAPACITY OF THE INFLOW PIPES AND ELEVATION SET BY INLINE STRUCTURE #1, WHICH DISCHARGES DIRECTLY TO THE ORIGINAL DRAINAGE COURSE FOR THE MINE DISCHARGE. IN ADDITION, IF THE OVERFLOW BYPASS PIPE BECOMES CLOGGED OR THE CAPACITY IS EXCEEDED, THE MINE DISCHARGE WOULD OVERFLOW THE CONCRETE MINE SEAL AND FLOW DOWN THE ORIGINAL DRAINAGE COURSE AND BYPASS THE TREATMENT SYSTEM.

2. EVERY THREE MONTHS, AT A MINIMUM, THE LIMESTONE POND (#1 POND) SHALL BE FLUSHED TO REDUCE THE ACCUMULATION OF METAL PRECIPITATES IN THE LIMESTONE VOID SPACES. FLUSHING OF THE LIMESTONE POND IS ACCOMPLISHED BY FIRST REMOVING ALL OF THE STOP LOGS IN THE INLET STRUCTURE OF THE SETTLING POND (#2 POND) AND DEWATERING THE POND. ONCE THE POND IS DEWATERED, REPLACE THE STOP LOGS IN THE INLET STRUCTURE. NEXT, REMOVE ALL OF THE STOP LOGS FROM THE INLINE STRUCTURE (#3) DESIGNATED FOR FLUSHING ONLY. ALLOW THE FLUSHING PROCESS TO OCCUR FOR AT LEAST 15 MINUTES AND REPLACE THE STOP LOGS IN INLINE STRUCTURE #3.

3. WATER LEVELS IN THE PONDS SHALL BE MAINTAINED AS FOLLOWS: #1 POND (LIMESTONE POND) SHALL HAVE THE WATER LEVEL SET JUST BELOW THE TOP OF THE LIMESTONE USING THE APPROPRIATE NUMBER OF STOP LOGS IN THE INLINE STRUCTURE (#2); INLINE STRUCTURE #3 SHOULD ALWAYS HAVE ALL OF THE STOP LOGS IN PLACE WHENEVER IT IS NOT BEING USED FOR FLUSHING); THE INLET STRUCTURE IN #2 POND SHALL HAVE THE WATER LEVEL SET AT A DEPTH OF APPROXIMATELY FOUR FEET FROM BOTTOM OF POND.

4. SLUDGE REMOVAL FROM THE SETTLING POND (#2 POND) WILL BE REQUIRED AS NECESSARY. SLUDGE LEVELS SHOULD NOT EXCEED MORE THAN TWO FEET IN DEPTH AT ANYTIME IN THE POND. IF EXCESSIVE SOLIDS ARE NOTED IN THE FINAL OUTFALL DUE TO REDUCED SETTLING TIME IN THE POND OR STIRRING UP OF THE ACCUMULATED SLUDGE, STEPS SHOULD BE TAKEN TO REMOVE THE SLUDGE AND PROPERLY DISPOSAL OF THE MATERIAL.

5. INSPECT VARIOUS COMPONENTS OF THE TREATMENT SYSTEM PERIODICALLY, PARTICULARLY AFTER SIGNIFICANT RAINFALL EVENTS TO ENSURE PROPER OPERATION. THESE COMPONENTS SHALL INCLUDE ALL INLINE AND INLET STRUCTURES, ROCK APRONS, EMERGENCY SPILLWAYS, BAFFLES, CONCRETE MINE SEAL, SCREENS AROUND THE MINE OPENINGS AND OVERFLOW BYPASS PIPE.

6. PERIODIC STIRRING OF THE LIMESTONE WITHIN #1 POND SHALL BE PERFORMED BASED ON VISUAL INSPECTION AND WATER CHEMISTRY DATA OF THE SYSTEM OUTFALL. IF THE WATER LEVEL IS PROPERLY MAINTAINED JUST BELOW THE SURFACE OF THE LIMESTONE BED, THEN VISUAL INSPECTION WILL BE DIFFICULT. THE BEST INDICATOR OF MAINTENANCE NEEDS FOR THE LIMESTONE IS THE WATER CHEMISTRY COMING OUT OF THE TREATMENT SYSTEM FINAL OUTFALL (#2 POND) DURING NORMAL OPERATION. IF SUFFICENT ALKALINITY IS NOT BEING GENERATED TO NEUTRALIZE NEARLY ALL OF THE ACIDITY AND/OR THE TOTAL ALUMINUM LEVELS ARE ELEVATED COMING OUT OF THE #2 POND OUTFALL, THEN THE LIMESTONE IN THE #1 POND NEEDS STIRRING. STIRRING OF THE LIMESTONE CAN BE ACCOMPLISHED USING A TRACK HOE FOR SEVERAL HOURS AND CHURNING OF THE TOP FEW FEET OF THE LIMESTONE BED, WHILE KEEPING THE PIPING SYSTEM AT THE BOTTOM OF THE LIMESTONE INTACT DURING THE PROCESS.

7. ANY AREAS SHOWING SIGNS OF EROSION SHALL BE REGRADED AND STABILIZED IMMEDIATELY WITH THE APPROPRIATE PERMANENT SEED MIXTURE AND MULCH.

SKELLY and LOY Inc. ENGINEERS–CONSULTANTS	09/30/07	DWG NO. C-1
AS-BUILT PLAN (REV. 1) BIG RUN #7 DISCHARGE MINE DRAINAGE TREATMENT PROJECT CONEMAUGH TOWNSHIP INDIANA COUNTY, PA PREPARED FOR: BLACKLEGGS CREEK WATERSHED ASSOCIATION		
1504076	SCALE: 1" = 60'	

APPENDIX B - SITE PHOTOGRAPHS

PHOTO 1–BIG RUN #7 MINE OPENINGS AND MINE SEAL

PHOTO 2–DOWNSTREAM VIEW FROM MINE SEAL OF LIMESTONE POND AND INLINE STRUCTURES

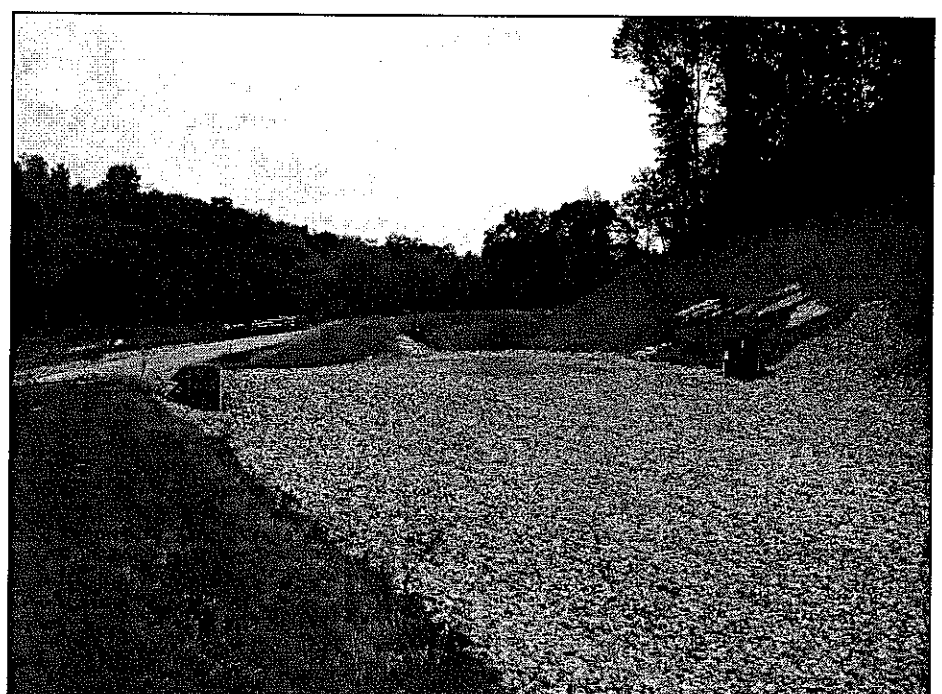


PHOTO 3–VIEW OF DOWNSTREAM END OF LIMESTONE POND, INLINE STRUCTURES, AND SETTLING POND

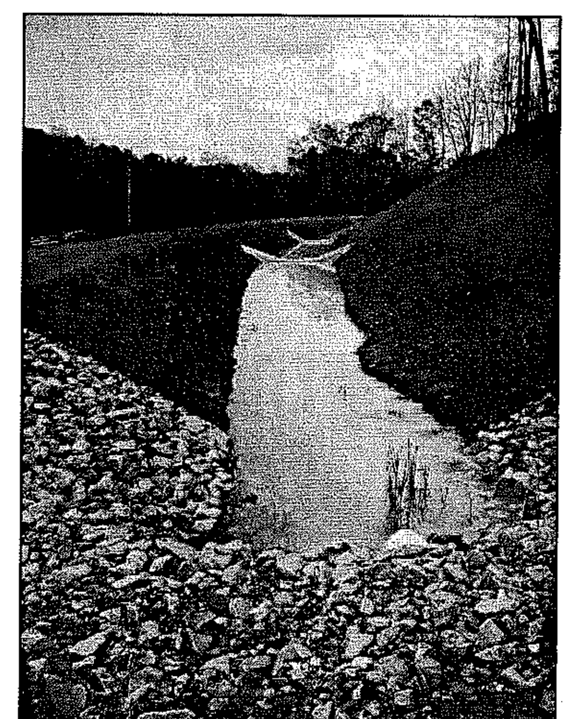


PHOTO 4–DOWNSTREAM VIEW OF SETTLING POND, BAFFLES, AND OUTLET PIPE FROM THE LIMESTONE POND

SKELLY and LOY Inc. ENGINEERS–CONSULTANTS	9/30/07	FIGURE 1
SITE PHOTOS BIG RUN #7 AMD PASSIVE TREATMENT SYSTEM CONEMAUGH TOWNSHIP INDIANA COUNTY, PA		
R04–0159	SCALE: NONE	

APPENDIX C - DRILL LOGS

BIG RUN #7 DRILLING

Hole #	Surface El	Description	Depth	Elevation*
13	1025.00	Coal	0-8'	1017
		Sandstone	12'	1013
14	1016	Hard rock	9'	1007
15	1034	Coal	0-5'	1029
		Split	~1'	
		Bottom coal	12'	1022
		Hard Rock	21'	1013
16	1036	Coal	2-14'	1022
		Hard Rock	24'	1012
17	1023	Coal streak near surface		
		Hard Rock	10	1013
18	1023	Hard Rock	10	1013
19	1012	Hard Rock	16	1006

*The vertical datum for the #7 survey is 7.7 feet lower than that used for Big Run #8. Add 7.7 ft. to BR #7 elevations to corolate to BR #8 elevations.

BIG RUN #8 DRILLING

Hole #	Surface El	Description	Depth	Elevation
1	1031	No void total depth 42'		
2	1031	Hard Rock	26	1005
		Hard 3' thick rock	36	995
3	1031	Bottom of Hole	38	993
4	1031	Small void (~6")	30	1001
5	1031	Big Void	31	1000
		Bottom of Void (discharge muddy)	39	992
6	1031	Void	30	1001
7	1039	Coal	0-6'	1033
		Void	42'	997
8	1042	Void	44'	998
8			*	
9	1031	hard clay	0-~3'	1028
9		Hard rock	11'	1020
10	1041	Coal	0-5'	1036
10		Underclay or weathered shale	5'-6'	1035
10		Hard Rock	11'	1030
11	1034	Hard Rock	16'	1018
12	1022	Clay rich soil	0-10'	1012
12		Water and coal streak	20'	1002
12		Hard Rock	24'	998

APPENDIX D -
BIG RUN #8 BID FORM

BIG RUN #8
ENGINEER'S CONSTRUCTION COST ESTIMATE

PASSIVE AMD TREATMENT SYSTEM
December 31, 2006

DESCRIPTION	ESTIMATED QUANTITY	UNITS	UNIT COST	TOTAL COST
MOBILIZATION	1	LS		
CLEARING AND GRUBBING	3	AC		
DISCHARGE CAPTURE STRUCTURE *	1	LS		
#7A MINE SEAL	1	LS		
DIRECTIONAL DRILLING	150	FT		
BULK EXCAVATION CUT	45,000	CY		
BULK EXCAVATION FILL	300	CY		
DISPOSAL OF EXCESS MATERIAL	44,700	CY		
MATERIAL DISPOSAL AREA PREP	1	LS		
LIMESTONE MATERIAL	4,800	TONS		
ECOTITE MATERIAL	1,000	TONS		
COMPOST MATERIAL	835	CY		
10" PERFORATED PVC PIPE	640	LF		
12" SOLID PVC PIPE	460	LF		
18" SOLID HDPE N-12 PIPE	720	LF		
24" SOLID HDPE N-12 PIPE	240	LF		
PIPE FITTINGS	1	LS		
ANTI-SEEP COLLARS	6	EA		
RODENT GUARDS	7	EA		
12" INLET STRUCTURE	2	EA		
12" INLINE STRUCTURE	3	EA		
18" INLINE STRUCTURE	1	EA		
24" INLET STRUCTURE	1	EA		
TYPE M INLET W/ TOP	1	EA		
INLET STRUCTURE WALKWAY	3	EA		
ROCK APRONS	2	EA		
18" CULVERT	40	LF		
ROAD REPAIR	1	LS		
ROCK CONSTRUCTION ENTRANCE	1	EA		
DIVERSION CHANNELS	500	LF		
GRASS-LINED EMERGENCY SPILLWAYS	3	EA		
SEEDING	2	AC		
MULCHING-STRAW	5	AC		
SILT FENCE	750	LF		
SEDIMENT TRAP	2	EA		

TOTAL ____________

* The Discharge Capture Structure could encounter problems during excavation, which may significantly impact the level of effort needed for construction. See conceptual drawing (Drawing No. C-1) for components required as part of proposed discharge capture structure.