

**2010 Abandoned Mine Reclamation Award:
Pennsylvania Submission**

**Barnes-Watkins Refuse Pile Reclamation Project
AMD 11 (Barnes-Watkins) 102.1, 103.1**



2010 ABANDONED MINE LAND RECLAMATION AWARDS

BARNES-WATKINS REFUSE PILE RECLAMATION

OSM 11(Barnes-Watkins)102.1, 103.1

PA 2469

Barr Township, Cambria County, Pennsylvania

Submitted By:

Commonwealth of Pennsylvania
Department of Environmental Protection
Bureau of Abandoned Mine Reclamation
Cambria District Office
286 Industrial Park Road
Ebensburg, PA 15931
Phone: (814) 472-1800
Fax: (814) 472-1839
Email: ecavazza@state.pa.us

Project Information

Project Start Date: Phase 1: 3/12/2004

Phase 2: 4/11/2005

Project Completion Date: Phase 1: 5/31/2005

Phase 2: 7/02/2008

Construction Cost:	Total AML:	\$4,284,157.86
	Match (PA GG):	\$ 90,000.00
	Match (CCCRA):	\$ 202,575.82
	Total:	\$4,576,733.68

Project Partner: Cambria County Conservation & Recreation Authority
401 Candlelight Drive, Suite 234
Ebensburg, PA 15931

Contractor: Robindale Energy Services, Inc., Armagh, PA

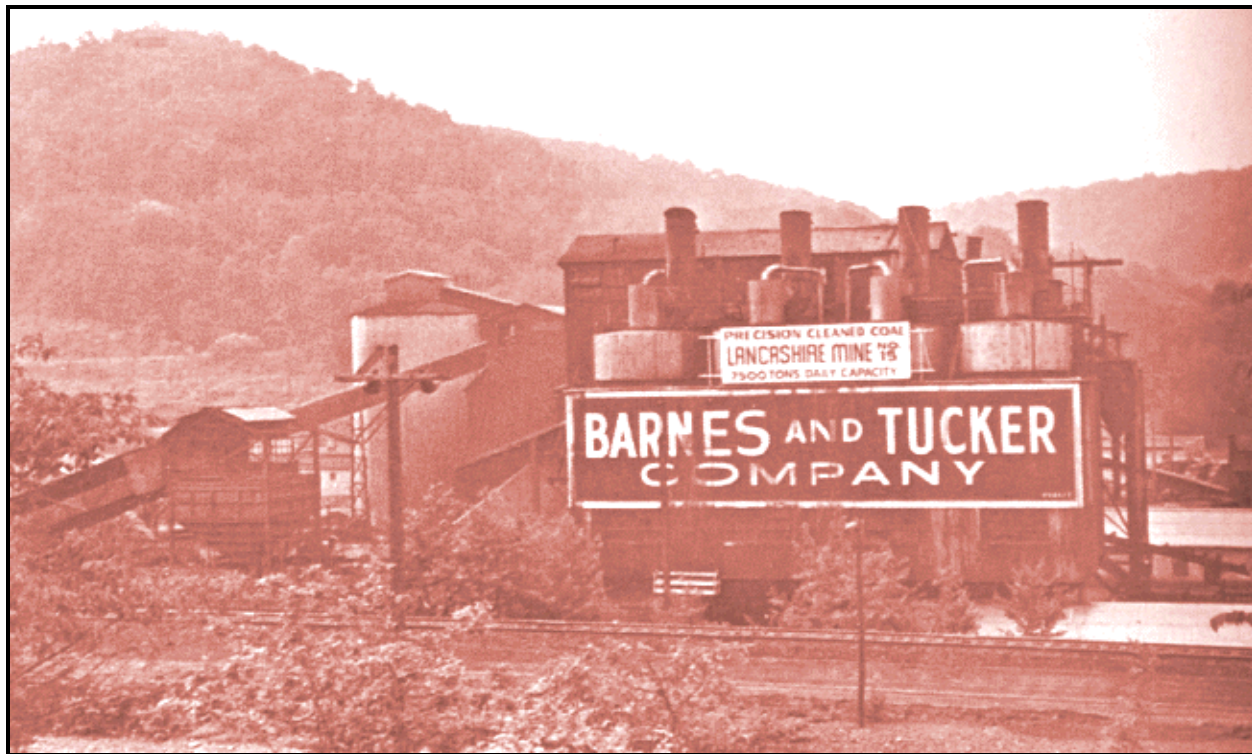
Property Owner: Cambria County Conservation & Recreation Authority

Nomination Team

Roderick A. Fletcher, P.E.	Director, Bureau of Abandoned Mine Reclamation
Eric E. Cavazza, P.E.	Environmental Program Manager
Pamela J. Milavec	Chief, Environmental Services Section
Jon J. Smoyer, P.G.	Licensed Professional Geologist, Project Advisor
Shirley Sholtis	Geologic Specialist
William Dadamo	Construction Manager
Earl Ropp	Project Inspector Supervisor
Patrick Ferko	Project Inspector

Submission Date: April 15, 2010

Introduction – Mining and Watershed Background



Former Barnes & Tucker Lancashire #15 Coal Cleaning Plant, circa 1955.

Barnes & Tucker (B&T) Coal Company began mining at the turn of the twentieth century and eventually operated 11 mines in the West Branch Susquehanna River watershed, which originates in Pennsylvania's northern Cambria County. Their Lancashire No. 15 Mine, in the very headwaters of the River, holds a significant distinction in mining regulatory history. B&T operated the Lancashire No. 15 deep mine from 1939 until July 1969, when the mine was sealed and closed. Following the closure, the mine began to fill with water and, in June and July 1970, substantial breakouts of AMD were discovered at two different locations. This caused major fish kills 35 miles downstream to the Curwensville Reservoir and in the West Branch below the reservoir, continuing as far as 200 miles downstream. The Commonwealth of PA initiated large scale emergency in-stream neutralization, which continued for several months and cost more than \$1.5 million. This incident resulted in lengthy legal proceedings between the Commonwealth and B&T. A Pennsylvania Supreme Court decision in 1974 upheld the state's authority to hold the company responsible for treating the discharge, which was precedent setting. The decision represented a turning point in environmental oversight of the coal industry, not only in Pennsylvania, but at the national level.

B&T developed the Barnes-Watkins refuse disposal area in order to deposit refuse from the Lancashire No. 15 and No. 18 Mines. The 1.3 million ton Barnes-Watkins refuse pile covered 18 acres and was situated on the bank of, and in some locations directly in, the West Branch Susquehanna River, near the village of Watkins in northern Cambria County. The pile contained steep, dangerous embankments, and was burning, causing degradation of the local air quality and adversely impacting the quality of life of the residents of Watkins.

B&T was responsible for treatment of the mine pool discharge. However, the uncontrolled AMD from the Barnes-Watkins refuse pile had profound impacts to the water quality of the West Branch

Susquehanna River, a major river system draining an area of 4.466 million acres in north central PA. As the stream flowed past the refuse pile, the iron and aluminum concentrations increased from an average of 3 mg/l upstream to approximately 20 mg/l downstream. Acidity increased an average of 170 mg/l. The National Office of Trout Unlimited has spearheaded efforts at the local, state and national levels to restore the West Branch Susquehanna River. That restoration would not be possible without removing the first significant source of pollution to the watershed – the Barnes-Watkins refuse pile.



Village of Watkins adjacent to refuse pile.



West Branch Susquehanna on the other side.

Difficulty of Achieving Reclamation under Existing Conditions

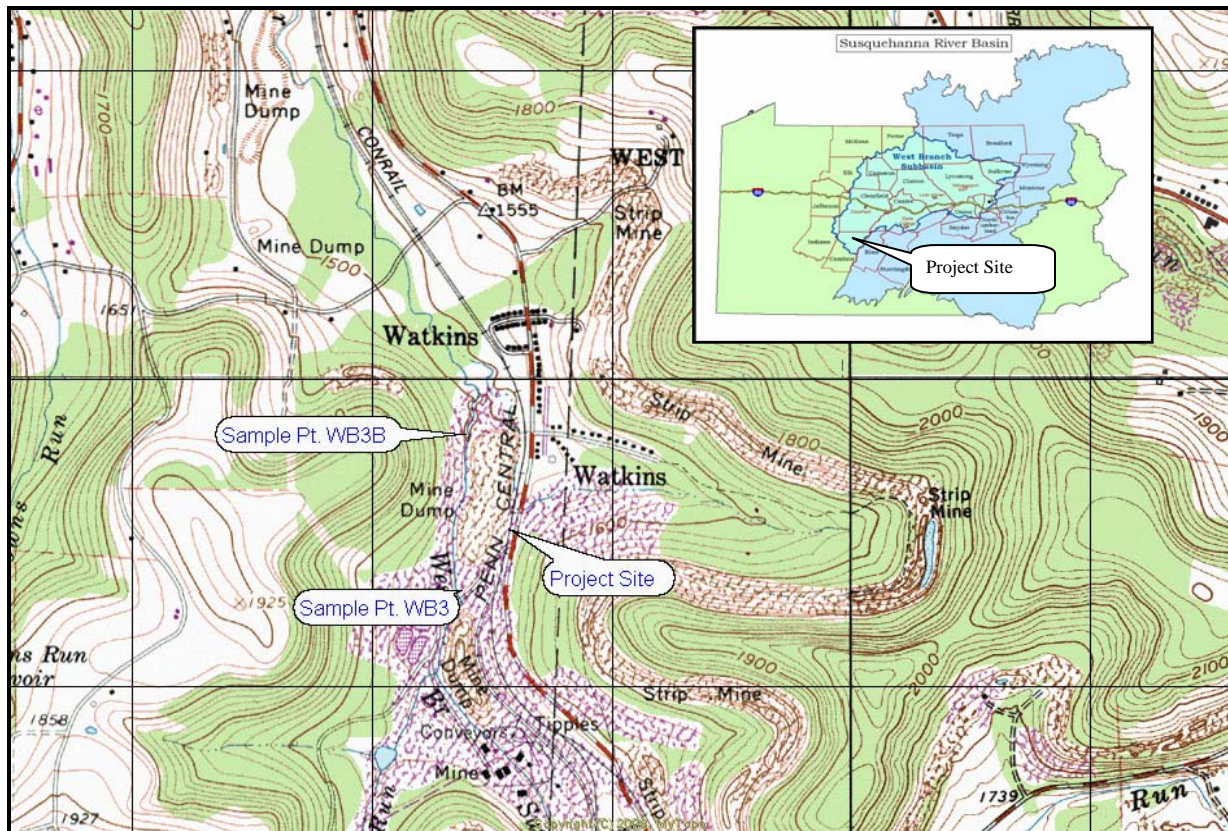


Figure 1. Map showing project location, sample locations and location of watershed in Pennsylvania.

Special and Unique Considerations

The Barnes-Watkins refuse pile was inventoried in problem area PA 2469, Feature #1, and identified by the OSM Priority 2 keywords of Dangerous Pile or Embankment (DPE) and Surface Burning (SB). The pile was located immediately along, and in some cases directly in, the West Branch Susquehanna stream channel, and diverted the river's flow to the west side. The pile was also slowly burning, degrading the local air quality; it was the source of uncontrolled erosion and sedimentation of acidic refuse material directly into the West Branch Susquehanna River; and it caused the formation and discharge of AMD.

After receiving complaints from the residents of the village of Watkins, starting in 1981, the Pennsylvania Department of Environmental Protection, Bureau of Abandoned Mine Reclamation (PA DEP-BAMR) began efforts to reclaim the Barnes-Watkins refuse pile in the mid to late 1980s. A reclamation plan was developed that included extinguishing the refuse fire, regrading the refuse pile to stable slopes, capping the pile with suitable borrow material, and revegetating the site. Due to inadequate space on the project area, it would be necessary to move some material to an adjacent area. However, the property owner of the refuse pile refused to cooperate due to his desire to pursue reprocessing of the refuse pile for use as a fuel material. During that period, the burgeoning co-generation industry in the area was buying up and reprocessing many other coal refuse piles in the vicinity. PA DEP-BAMR attempted to work with the property owner until late 1993, when a decision was made to suspend the project.

In the mid 1990s PA DEP-BAMR worked with private entities and other partners to facilitate exploration and testing of the pile to determine if the material in the pile would be suitable as fuel for a fluidized bed combustion power plant. Results showed that a portion of the material met standards for use as waste coal fuel. A local watershed restoration group, the Susquehanna River Rescue, was formed around this time, and the group identified the Barnes-Watkins refuse pile as a priority for reclamation. As a result, in 1996, PA DEP-BAMR solicited a proposal from Robindale Energy Services, Inc. (RES), a local coal refuse reprocessing firm working in the vicinity of the Barnes-Watkins refuse pile. RES also operated a nearby permitted refuse disposal facility that could potentially serve as a location to deposit any material that was not suitable as a fuel source. The RES cost proposal was too high for PA DEP-BAMR to pursue at that time; however, it would serve as the basis for negotiations over the next seven years for removal of the pile.

PA DEP-BAMR continued to look for a cost-effective reclamation alternative for the Barnes-Watkins refuse pile. Several events occurred between 1999 and 2003 that ultimately led to a partnership that facilitated the total removal and restoration of the site. These events finally provided an opportunity for a partnership between PA DEP-BAMR and several other entities that resulted in the complete removal and restoration of the Barnes-Watkins refuse pile, beginning in 2004 and concluding in 2008. The partnership included the Cambria County Conservation and Recreation Authority (CCCRA), RES, Reliant Energy, a company operating a new co-generation power plant in the area, and PA DEP-BAMR.

On-site difficulty of the project

The location and the nature of the Barnes-Watkins refuse pile created difficult reclamation obstacles. The perimeter of the pile was bordered and confined by the West Branch Susquehanna River, local roads and the village of Watkins. These constraints meant that grading and capping the entire pile on site was not a viable option, even without the water quality concerns. Reclaiming the site in a manner that addressed health and safety, as well as water quality concerns, required that the entire pile be economically removed.

Many coal refuse piles in the local area, including three piles immediately upstream of the Barnes-Watkins refuse pile, had been mined for fuel for one of the three [waste-coal, co-generation fluidized bed combustion](#) (FBC) power plants that had been constructed in the vicinity in the early 1990s. The quality of the refuse in the Barnes-Watkins refuse pile was tested and found to be sub-par when compared to the

fuel standard set by co-generation facilities that were operating in the region. The FBC plants in operation typically utilize refuse that is 7,500 to 9,000 Btu/pound and less than three percent (3%) sulfur. The fuel content determined through sampling of the Barnes-Watkins refuse pile was very inconsistent, with some zones of the pile having a Btu content over 8,500 Btu/lb and others containing previously burnt refuse or “red dog”, low Btu shale, and what appeared to be mine drainage treatment sludge. In addition, the Barnes-Watkins refuse material contained greater than six percent (6%) average sulfur, which requires more limestone to control emissions and greatly increases the cost of burning this refuse. For these reasons, the Barnes-Watkins refuse pile was not remined by private industry and remained while the piles near it were reclaimed by the late 1990s. If the majority of the pile could be not be utilized as fuel, it would have to be removed and properly disposed of in an environmentally sound manner.

Economical pile removal would require a local refuse disposal site. Fortunately, RES had a permitted coal refuse disposal site, known as the #25 Site, located adjacent (about 1/4 mile away) to the Barnes-Watkins refuse pile. This refuse disposal site was clearly the most and, in reality, the only economical place to take the portions of the pile that could not be used as fuel in order to eliminate the hazards and remove the refuse pile from the West Branch Susquehanna River.



Barnes-Watkins refuse pile during construction in foreground and RNS permitted disposal site in background.

However, it was clearly advantageous to use as much of the pile as possible as fuel. In 2003, Reliant Energy brought on-line their new [Seward Generation Station](#). This power plant is a 521 megawatt waste-coal, fluidized bed combustion burner-type generating facility capable of burning 6,000 Btu/pound quality refuse. The fuel specification for this plant was lower than any seen in the region and allowed for a more significant portion of the refuse pile to be utilized as fuel. However, with the inconsistent nature of the

Barnes-Watkins refuse pile, it was not known for certain what portion of the pile could be utilized as fuel. Government funding, along with a local disposal area, was still needed to ensure complete removal and reclamation.

The final hurdle to moving forward with the project, the uncooperative landowner, was resolved when the landowner sold the property containing the refuse pile to the CCCRA in 2000. The county agency purchased the property simply with the goal of addressing the AML issues associated with the refuse pile.

Project start and completion date, construction costs, and names of organizations involved

In 2004, the PA DEP awarded a grant, primarily using OSM Title IV funds, in the amount of \$1,214,872, for Phase I of the Barnes-Watkins Refuse Pile Reclamation Project. The agreement between the CCCRA and PA DEP spelled out several key requirements. First, it called for complete removal of the refuse pile, including eliminating all of the physical hazards and extinguishing the fire, at a price of \$3.85/cubic yard. Second, the subcontractor, RES, would pay CCCRA \$0.25/ton for every ton of fuel taken to the Seward Generating Station, with this money returned to the project. Third, the floodplain for the West Branch Susquehanna River was to be re-established along the perimeter of the project area. Fourth, the reject-refuse material was to be hauled to the RES permitted disposal site and blended with fluidized bed combustion ash at a ratio of 1:1 in order to allow for complete encapsulation and neutralization of the acidic coal refuse material. Finally, the agreement allowed for a phased and cautioned approach to reclamation. If, after Phase I, it became apparent that all the economic analyses for reclamation of the pile were incorrect, then the areas disturbed to that point would be reclaimed and the project ended. Conversely, if all went according to plan, additional phases would be funded to continue uninterrupted reclamation activities on the pile.

PA DEP-BAMR completed an evaluation of the project near the conclusion of the first phase of the project and, based on that evaluation, decided to continue efforts to complete reclamation of the pile. A grant for Phase II was awarded to CCCRA in 2005 in the amount of \$3,188,958 to complete reclamation, entirely using Title IV funds. The project moved from Phase I to Phase II in a completely seamless manner. The entire project was completed and the site restored by July 2, 2008.

Date submitted

This nomination was submitted April 15, 2010.

On-Site Effectiveness



Barnes-Watkins refuse pile during reclamation; Phase 1, to the left, receiving FBC ash.

Effective/innovative use of technology

The PA DEP-BAMR and the CCCRA gave the subcontractor much flexibility to sequence the reclamation activities, provided that the project met the contract goals of complete reclamation. PA DEP-BAMR construction staff provided oversight on a daily basis and met frequently with the subcontractor in order to address problems as they arose. Much credit is due to RES for making every effort to utilize as much of the refuse as fuel as possible. RES often hauled low Btu or high sulfur refuse to their permitted refuse disposal site to blend the material in order to meet the fuel specification at Seward. At times, the refuse was triple or quadruple handled before it was delivered to the Seward Generating Station.

Significant challenges were encountered during the construction phases of this project. The first difficulty involved measurement of the total cubic yards to be moved with this reclamation project. Since the payment was to be made upon a cubic yard basis, this item was at the forefront of issues to be addressed. It was agreed upon that both PA DEP-BAMR's in-house survey crew and the contractor's hired surveyor would survey the pile prior to commencing work, and then resurvey it at least monthly or as needed in order to calculate the total cubic yards removed. This became even more difficult when the bottom of the refuse pile was found to be located in the old river bed and was actually at an elevation lower than the present elevation of the West Branch Susquehanna River. The final design of the site allowed for amended low sulfur material to be left within the footprint of the site, but the contractor was to be paid for all cubic yards of refuse handled regardless of final destination. Every time original bottom material was encountered beneath the pile, the elevations had to be surveyed in order to account for the total material moved.

Landscape conforms to the natural environment

When the bottom of the coal refuse pile was found to be below the existing level of the West Branch Susquehanna River, another problem was encountered: how to keep the river from infiltrating and leaching through any material placed on the bottom of the footprint of the pile. The area had to be filled in order to re-establish grade and prevent the river from impounding where the Barnes-Watkins refuse pile once sat. The most viable solution was to place remediated, burnt refuse and the lowest sulfur shale available and compact it in order to form a nearly impermeable concrete-like block to keep the river in its existing channel. The photo below shows the bottom "block cut" of the pile below existing river grade.



Barnes-Watkins project in construction: encountering river-level infiltration.

Elimination of significant health and safety problems

Fortunately, the fires within the pile were not widespread. The areas of burning refuse encountered were spread with an excavator on a pad of FBC ash and extinguished. RES had air monitoring equipment, self rescuers, and fire suppression equipment on machines that operated near the fires.

When the project was complete, it ended successfully with all of the original project goals being met. All of the OSM Priority 2 hazards (DPE, SB) were completely reclaimed and most of the Priority 3 mine drainage seeps were also eliminated.

Funding

A breakdown of the total funding versus Abandoned Mine Land Funding by Phase of the contract follows:

FUNDING				
	OSM Title IV funds	PA Growing Greener State funds	Contribution from CCCRA from fuel tonnage	Total
Phase I	\$1,124,872.50	\$90,000.00	\$ 4,750.47	\$1,219,622.97
Phase II	\$3,159,285.36	-	\$197,825.35	\$3,357,110.71
Total	\$4,284,157.86	\$90,000.00	\$202,575.82	\$4,576,733.68

Total cubic yards of refuse moved, abated, compacted, graded, and vegetated: 1,264,000 (approximately 67 percent was ultimately recovered as fuel).

Effective use of funds

While this project was not inexpensive, traditional reclamation with treatment of the AMD produced would have been much more costly. PA DEP-BAMR developed a cost estimate for traditional reclamation in 1986. This estimate, which included grading, partial removal of pile to acquire proper grade, soil conditioning and revegetation, was \$2,752,000. Adjusted for inflation, that amount would have increased to \$4,743,182 by 2004 (US Dept. of Labor inflation calculator). However, this project would not have addressed the AMD contamination of the West Branch Susquehanna River. Installation of an on-stream lime doser would have neutralized the acidity but would not have removed metals contamination. A cost estimate of this neutralization is \$133,000 in capital costs and a 50 year pay-out in operation and maintenance of \$3,413,520. These costs added to the reclamation costs would have resulted in a total expenditure of \$8,289,702. Metals contamination would have continued and burnable fuel would not have been recovered from the pile.

Leveraging

The leveraged funds matched to the expenditure of OSM Title IV funds totaled \$292,575.82.

Benefits to the Community

Community support for the project

Residents of the village of Watkins were very concerned about the impacts of the Barnes-Watkins pile on their community. According to Mrs. Snyder, a resident of the adjacent village of Watkins and the first to register a complaint, back in 1981, “The smell and smoke are the source of my and my older neighbors’ coughing conditions.” She also expressed concern about impacts of dust from the pile. Others in the

community expressed concern about kids riding bikes on the pile. In addition, with the formation of the Susquehanna River Rescue, local groups also began to focus on the water quality impacts of the pile and the need for its removal. The CCCRA, a local government entity, purchased the pile with the sole purpose of facilitating reclamation.

Long-term benefits to the community

The Barnes-Watkins Refuse Pile Reclamation Project successfully eliminated the following abandoned mine land keyword features: Dangerous Pile and Embankment (DPE), and Surface Burning (SB), and largely eliminated the Priority 3 Water Problems (WA). The surrounding community is now safer because these hazards have been reclaimed. In addition, they no longer must deal with the dust from the pile and the sulfuric smell of the refuse fire. Alice Paronish, a lifelong resident of Watkins, described the project as “wonderful”! She went to school next to the pile, which was burning at the time, and she’s very happy that it’s gone. “My goodness, it’s much better to breathe now!” she said. She’s happy that her grandchildren, who also live in the area, won’t have to grow up breathing the smoke and dust from the pile. She said the project did great things for Watkins and called it an “asset” to Watkins (personal communication, April 9, 2010).

One of the most remarkable improvements has come in improvements to the West Branch Susquehanna River. The refuse and coal fines are no longer eroding into the river. The river has room to properly flood and dissipate energy during high water events and is no longer infiltrating through the pile as it tries to follow the old river bed through the center of where the pile was once located. The water chemistry of the West Branch Susquehanna has improved dramatically.

Continuous monitoring of the stream by PA DEP-BAMR has shown the extent of the impacts of removing the Barnes-Watkins refuse pile. The stream was being monitored just upstream of the site (WB3) and just downstream of the site (WB3B) (see Figure 1). Background samples date back to 2001, with a few going back to 1991. These two monitoring points were monitored on a regular basis during construction (June 2005 to December 2007) and after reclamation was completed.

The removal of the refuse pile has resulted in a significant decrease in aluminum and iron concentrations (and loading). Acidity levels also are substantially lower. The project removed 1,600 lbs/day of acidity, 120 lbs/day of iron and 245 lbs/day of aluminum on average. This is equivalent to 290 tons acid, 22 tons of iron, and 44 tons of aluminum removed from the headwaters each year. Although there are fluctuations, the stream at WB3B now has an average of 6 mg/l iron, 5 mg/l aluminum, and 20 mg/l acidity as CaCO₃. (See Figure 2 at the end of the document). In addition, the water quality improved slightly at WB3B for arsenic, beryllium, cadmium, copper, and zinc - going down to levels found upstream at WB3. These are parameters that are often a concern with the use of coal ash. This monitoring indicates no adverse impact from the use of FBC ash on this site.

In 2008, BAMR conducted an aquatic survey of the West Branch Susquehanna River headwaters. In general, aquatic life is still impaired but improved since a previous study conducted in 2001. The macroinvertebrate communities sampled downstream, while still marginally impaired, have shown significant improvement since the 2001 survey. A fish survey has shown surprising recovery of the fishery, including the capture of young of year trout approximately 10 miles downstream of the project. Recreational fishing is occurring in sections of the stream that have been dead for decades!

Other projects planned in the headwaters, including a mine drainage treatment plant currently in construction, are expected to restore the stream for a distance of 35 miles. This restoration could not have occurred without removing the pollution load from the Barnes-Watkins refuse pile. These recovery efforts on the West Branch Susquehanna River are strongly supported by local groups, including the Susquehanna River Rescue, as well as the national office of Trout Unlimited and the multi-state

Susquehanna River Basin Commission. The Barnes-Watkins Refuse Pile Reclamation Project resulted in the first significant effort to restore the West Branch Susquehanna River.

The property is still owned by CCCRA, and they are currently considering options to provide the best public use of this reclaimed parcel of land.



A local, young fisherman with a wild brown trout caught 10 miles downstream of the pile. Fishing this section was unheard of prior to the reclamation of the Barnes-Watkins refuse pile.

Surface Mining Control and Reclamation Act

Exceeds the spirit and intent of SMCRA

This project exceeded the spirit of SMCRA in several ways. It improved the quality of life for the people living in a small community that had co-existed for decades with a refuse pile that contaminated the surrounding air, land and water. The project provided the first significant effort to restore a major watershed that has received attention from both local and national organizations. In addition, the 820,000 tons of fuel removed from the site and burned at a co-generation facility provided 984,000,000 KWH of electricity, enough to power all the 66,263 homes in Cambria County, PA for more than 15 months!

Increased public awareness of SMCRA

The reclamation of the Barnes-Watkins refuse pile received much attention due to the magnitude of the changes it has brought to the local area. The landscape is literally unrecognizable when compared to its appearance six years ago. The project was featured in the local newspapers on several occasions and

brought much attention to abandoned mine reclamation (*Johnstown Tribune-Democrat*, 9/20/2003, 5/3/2004, 10/11/2006, 10/16/2006, 2/22/09, 2/28/09, *Centre Daily Times*, 3/9/2009).

Transferability to other AML projects

This project demonstrated the value and feasibility of partnering with industry to achieve reclamation of uneconomical refuse piles. While many piles in the Commonwealth are being reclaimed by industry, with no government expenditures, there are many more that are not economically viable. This project provided both the technical and administrative methodology needed to address these piles. The project also demonstrated the importance of AML reclamation to achieving watershed restoration. A significant amount of AMD was removed from the headwaters of a major river system, initiating a watershed recovery. The AMD was permanently removed, with no need for the construction of treatment facilities and their related operation and maintenance costs. This project exemplifies the characteristics that reflect both the spirit and intent of SMCRA in the protection of public health, safety and the environment from adverse effects of past coal mining practices.

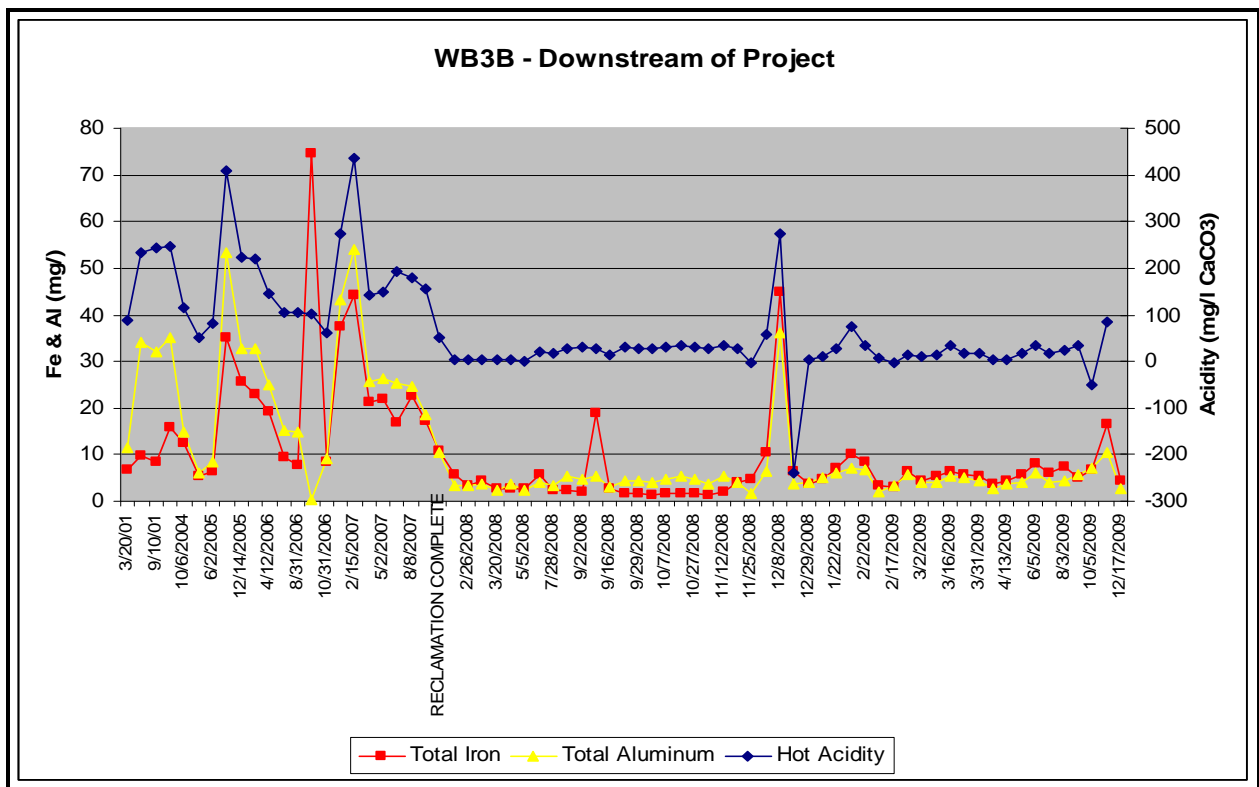


Figure 2. Water Quality of the West Branch Susquehanna River below site, before, during and after project.



Elemental Sulfur Bipyramids crystallized in partially coked coal refuse from Barnes-Watkins refuse pile (specimens were donated to and accepted by the Carnegie Museum of Natural History, Pittsburgh).

Additional Photos of Project in Construction and upon Completion



First scoop of refuse being removed from project area.



Working through the pile – a long way to go!



Extinguishing the fire.



FBC ash being applied during reclamation.



Completion of FBC ash application on Phase 1.



Completion of seeding at Barnes-Watkins site.



Reclaimed Barnes-Watkins site.



Aerial view of reclaimed Barnes-Watkins site in foreground, with village of Watkins and RNS disposal site in background.