**REESTABLISHED LUCKY RUN CREEK, McDADE PARK,
CITY OF SCRANTON AND TAYLOR BOROUGH, LACKAWANNA COUNTY,
PENNSYLVANIA**

PENNSYLVANIA
2003 NOMINATION
ABANDONED MINE LAND RECLAMATION AWARD

PROJECT
Keyser Ave/ Scranton

LOCATION
McDade Park
City of Scranton and Taylor Borough
Lackawanna County, Pennsylvania

SUBMITTED BY
PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF ABANDONED MINE RECLAMATION
WILKES-BARRE DISTRICT OFFICE
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PROJECT DESIGN AND MANAGEMENT
Bureau of Abandoned Mine Reclamation
Wilkes-Barre District Office

IN PARTNERSHIP WITH
Office of Surface Mining Reclamation and Enforcement
Lackawanna County
Lackawanna County Conservation District
Lackawanna River Corridor Association
DEP Bureau of Dams and Waterways
Anthracite Heritage Museum
Thomas McLane, ASLA Lackawanna County Landscape Architect

PROJECT INFORMATION
Contractor: Tim Kohrs Excavating
Start Date: January 25, 2000
Completion Date: December 6, 2000
Construction Cost: $318,380.05

DATE SUBMITTED
March 10, 2003

HISTORY

The Keyser Avenue/Scranton Mine Reclamation Project is located in McDade Park in the City of Scranton and Taylor Borough, Lackawanna County. The Federal Bureau of Mines and Lackawanna County constructed the McDade Park in 1976. The cooperative agreement between the organizations called for a demonstration project to reclaim abandoned strip pits and develop them into a public recreational, historical and educational park. The park was built on 125 acres and consists of campgrounds, play areas, sports facilities, and a picnic area. The Anthracite Museum, which was constructed by the Pennsylvania Historical and Museum Commission, is located on the same grounds.

A section of Lucky Run Creek that originally meandered throughout the area and was removed during extensive strip-mining operations was reestablished as part of the demonstration project. The method used to reestablish the creek was to distribute a bentonite clay seal throughout the creek bottom. The clay seal was applied in successive passes until no significant loss of water was detected. The bentonite clay seal formed an impervious barrier between the water and the strip-mined areas. Rock was used to line the creek bottom and to stabilize the slopes.

To further enhance the park into a historical and educational site, the project sponsors restored the abandoned underground mines and established a tourist attraction that offered guided tours into the abandoned underground mines. The abandoned underground mines became a major attraction to the general public and students from the community school systems.

Subsequently, problems began to develop as water started to infiltrate into the abandoned underground mines and affect the mine tours. In addition to causing damage to the mine tour operations, the water flowed to the lower level of the underground mine workings. The Acid Mine Drainage produced as a result of the reaction between the water and the mine workings continually discharged into the Lackawanna River. The severe bank and stream bed erosion in Lucky Run Creek caused sedimentation and channel blockages. It was determined that the water

entering the mine tour was actually a result of water infiltrating from Lucky Run Creek, apparently caused by failure of the bentonite clay seal (see photograph, *Degraded and Dry Streambed*). The mine tour operators continued their operation; however, the problem became worse and caused havoc with the tours. The tour operators were on the verge of discontinuing their operations for safety reasons.

It was at this point that the Bureau of Abandoned Mine Reclamation in the Pennsylvania Department of Environmental Protection (PA DEP) was approached by County Officials to develop and design a project to rehabilitate the creek channel of Lucky Run Creek. This project would also result in the elimination of this source of pollution to the Lackawanna River.

DESIGN

Because the path of the eroded stream channel crossed the area of the park where the campgrounds and picnic areas were located, the designers decided to try a different and unique approach for the reconstruction of the stream channel. The focus of the design was to construct a stable channel, to prevent infiltration through the fractured stream channel, and to construct the channel to a natural and rustic appearance to blend into the natural park setting. After an extensive and thorough investigation of the existing site conditions, the designers determined that a fluvial geomorphology design concept was the best approach to meet the project objectives. The choice of a Natural Channel Design helped in building local support for the project and also provided the opportunity to demonstrate the effectiveness of this methodology.

Using the "Rosgen Classification of Natural Rivers", Lucky Run Creek was determined to have once been an "A" channel. This conclusion was reached based on the existing Type 1 Valley and a Valley Slope of 9.6%. It was also determined that boulder material would be needed to construct the channel because of the size of material that was being moved by the force of the water.

The designers first determined bankfull discharge by measuring existing conditions for this 1.1 square mile watershed. Data was collected by delineating the bankfull indicators and then surveying for the cross-sectional area and channel slope. The bankfull cross-sectional area was measured and determined to be approximately 25 square feet. This data was then used to calculate a bankfull discharge of 60 cfs. The level of confidence in this result was enhanced through comparisons with a regional hydrology curve of Eastern Pennsylvania, and the output from computer hydrology model. Once the value of the bankfull discharge was established, the bankfull channel dimensions were gleaned from the regional curve. The bankfull width was established at 16 feet, the bankfull cross-sectional area at 25 square feet, and the mean bankfull depth at 1.75 feet.

One of the design tasks was to develop a solution to eliminate water infiltration. It was decided to undercut the existing streambed a minimum of 2 feet and install a PVC liner. The design incorporated backfilling the liner using existing material from the streambed. Rocks excavated from within the existing streambed were stored at the site and later used for reestablishing the creek channel. In order to achieve maximum compaction, material was screened and sized.

In order to create the natural and rustic appearance of the stream channel, the designers proposed a fluvial geomorphology channel and incorporated existing rock from the streambed and trees with the roots intact from the embankment areas. The fluvial geomorphology control devices consisted of vortex weirs, step pools, plunge pools, channel pools, channel pools with rock veins and channel pools with root wads. These devices were installed directly into the stream channel to eliminate bank erosion, provide habitats for fish and macroinvertebrates and to prevent aggregation or degregation of the stream channel.

CONSTRUCTION

The Bid Opening for this project was held on October 19, 1999. Ten bids were received, with the low bid submitted by Tim Kohrs Excavating of Honesdale, Wayne County, Pennsylvania. Tim Kohrs Excavating had previously performed stream rehabilitation work for the Department and enjoyed a reputation as a conscientious and experienced contractor. The contractor's cooperation and workmanship played an important role in assuring the success of the project. The contractor took a personal interest in the project and worked very closely with Department personnel to ensure that the control devices used throughout this fluvial geomorphology designed project were installed correctly and functioned properly.

Work at the site was scheduled to start January 25, 2000, but the contractor elected to postpone the physical start of the work until April 6, 2000. As it turned out, the contractor's decision resulted in most of the work being conducted in extremely low flow conditions. The contractor did have to contend with a few storm events that caused work to stop for a few days, but his handling of the water was such the work could resume quickly. The contractor was aided in the control of the water by a small upstream impoundment that the County Park maintained to provide a source of water for a pond elsewhere in the park via an underground pipe system. Because the park was heavily used, the contractor had to be extra vigilant in protecting the public's safety and was also constantly under scrutiny by a large number of "sidewalk superintendents".

As required by the contract, the contractor constructed the channel in sections, completing one section before moving to the next to minimize any erosion and sedimentation problems. The contractor excavated the channel to the new channel geometry, undercutting the existing streambed a minimum of 2 feet. Using an on-site facility, the excavated material was stockpiled and screened to comply with the gradation requirements of the contract. The graded streambed area was prepared with a 2-inch layer of sand, followed by the installation of impervious lining consisting of 30 mil thickness PVC (see photograph, *Construction of PVC Impervious Lining*). The impervious lining was installed to prevent water from infiltrating into the underground abandoned mines. Grout was used to seal any fissures in the rock where

existing bedrock was exposed. Small rocks were imbedded in the grout while it was still in a plastic state to give it a more natural appearance. The channel was constructed atop the impervious liner using the screened material. The screened material was shaped and compacted to form the new bottom and sides of the channel. Flow control and embankment stabilization devices such as cross vanes, step-pools, plunge pools, channel pools, channel pools with rock vanes and channel pools with root wads were constructed.

Step-pools were integrated into the overall design to help dissipate stream energy and to provide a diverse habitat for stream organisms. Each step began and ended with a cross vane constructed of the quarried block rock. The cross vanes had two purposes: to establish grade control and to direct flows toward the center of the channel. The steps were lined with weathered boulders removed from the old channel. The pools were designed with a rock-lined scour hole to protect the liner and rock vanes or root wads and to protect the bank and deflect velocities. The rock vanes were constructed using block rock (see photograph, *Construction of Channel Pools with Rock Vanes and Plunge Pools*) and the root wads were constructed from salvaged large trees removed during construction (see photograph, *Construction of Channel Pools with Root Wads*). The placement and elevation of each of these devices were critical in order for them to function properly, to the point that the contractor removed and reinstalled several of the devices to make sure they were correctly positioned. The contractor liked the unique aspects of this project and his excitement at being a part of the project was reflected in his work. He took one particularly large stone that he had unearthed during the construction and strategically placed it near the top of the stream embankment near a rock waterfall area. He christened the stone the "reflecting rock", a place where park visitors could sit near the waterfall and reflect on the view. It was this kind of personal involvement by the contractor that contributed to the success of the overall job.

Construction was completed on November 30, 2000 with a final construction cost of $318,380.05. The project reestablished 1,079 linear feet of Lucky Run Creek and encompassed 2.8 acres of reclaimed land (see photograph, *Reestablished Lucky Run Creek Without Landscaping*).

ACCOMPLISHMENTS

The creek channel has functioned in all aspects as predetermined during the design. The site is continuously monitored for stability and morphologic changes by cross-section and visual inspection. The following accomplishments have been documented:

1) Baseflow has been returned to the newly constructed 1,079 linear foot section of Lucky Run and to approximately 3,000 linear feet of channel downstream of the project.
2) Acid Mine Drainage to the Lackawanna River has been reduced.
3) The Anthracite Underground Mine Tour no longer experiences the adverse effects from infiltration of water through the streambed.
4) Bank erosion and culvert blockage problems have been corrected.
5) The aesthetic beauty of McDade Park has been enhanced.
6) A diverse community of macro invertebrates has inhabited the restored section of Lucky Run Creek.

PARTNERSHIP

The project team was drawn from staff of the Wilkes-Barre Field Office, Bureau of Abandoned Mine Reclamation in the PA DEP. Members of the project team realized that for the project to be successful, they would need to partner with the various stakeholders associated with McDade Park and the Coal Mine Tour. Project team members, working with Lackawanna County officials, identified and contacted key stakeholders and asked them to become partners in the reclamation of Lucky Run Creek. These partners included the federal Office of Surface Mining, Lackawanna County, Lackawanna County Conservation District, Lackawanna River Corridor Association, PA DEP Bureau of Dams and Waterways, Anthracite Heritage Museum, and Lackawanna County's Landscape Architect. The formation of these partnerships helped to ensure the success of the project by having all of the stakeholders understand their part in the project, creating a feeling of unity and willingness to do whatever was necessary to make this project noteworthy. Lackawanna County agreed to do all landscaping and planting in the

riparian zone and were able to secure $80,000 to complete the site (see photograph, *Reestablished Lucky Run Creek, McDade Park*.)

CONCLUSION

The design and construction of this project was extremely difficult due to the complexity and unique approach in the design concept. It took a vigilant effort from the planners, designers, inspectors, contractor and local officials to work in unison to restore Lucky Run Creek to a beautiful and beneficial site that can be enjoyed by everyone.

The benefits of this project are not only linear feet of channel that was constructed as a natural stream and the elimination of acid mine drainage, but the demonstration of what can be accomplished when all parties work together.

PHOTO NO. 1
DEGRADED AND DRY STREAMBED

PHOTO NO. 2
CONSTRUCTION OF PVC IMPERVIOUS LINER

PHOTO NO. 3
CONSTRUCTION OF CHANNEL POOLS WITH ROCK VANES AND PLUNGE POOLS

PHOTO NO. 4
CONSTRUCTION OF CHANNEL POOLS WITH ROOT WADS

PHOTO NO. 5
REESTABLISHED LUCKY RUN CREEK WITHOUT LANDSCAPING