MONASTERY RUN PROJECT

Federal Office of Surface Mining
2000 AML Reclamation Award
Nomination Information

Submitted By:

Pennsylvania Dept. of Environmental Protection, Bureau of Abandoned Mine Reclamation

Date Submitted :

March 2000

Project Name:

Monastery Run Project (Consisting of five separate projects completed through the cooperative efforts of all of the members of the Loyalhanna Creek Mine Drainage Coalition)

Project Numbers:

A Partnership Effort in Watershed Restoration including OSM funded Project Nos. AMD 65(2533)102.1, Monastery Run, and OSM 65(1776)101.1, Beatty Road

Project Location:

The project is located in Unity Township, Westmoreland County, 2 miles southwest of the small community of Latrobe, PA., along State Route 1045 (Beatty Road) adjacent to St. Vincent College.

Team Members Submitting Nomination:

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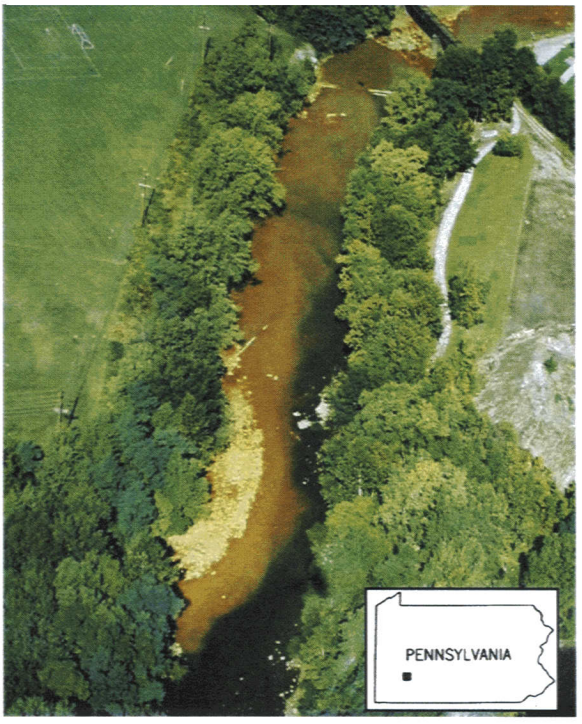
Construction Information:

Construction information for the various projects is contained within the site specific fact sheets. The fact sheets are included within this nomination.

History and Background

Monastery Run is located in Westmoreland County, PA, and is within the Loyalhanna Creek drainage system. Monastery Run is contaminated by abandoned mine drainage (AMD) entering from Fourmile Run, a major tributary. Monastery Run provides the first significant source of AMD to Loyalhanna Creek, near the Borough of Latrobe. Upstream of this point, Loyalhanna Creek, according to the Pennsylvania Fish Commission, is one of the most heavily fished stretches of stream within the state of Pennsylvania, and provides recreational benefits to a moderately populated area less than 40 miles from the City of Pittsburgh. Downstream of Monastery Run, Loyalhanna Creek is severely degraded by iron precipitate coating the stream bottom from Monastery Run and adjacent discharges. About 2 miles further downstream, mine drainage enters from two other tributaries, adding to the degradation of Loyalhanna Creek downstream to Loyalhanna Lake. The devastating effects of the mine drainage adversely impact the water quality for a total distance of approximately 17 miles within Loyalhanna Creek, 1 mile within Fourmile Run, and 1 mile within Monastery Run.



Confluence of Monastery Run and the Loyalhanna Creek just upstream of Latrobe, PA. (WCCD - 1993)

Loyalhanna Creek as it flows through downtown Latrobe. Note the impact of the AMD from Monastery Run. (WCCD - 1993)

The coal mines in the region surrounding the Monastery Run project sites were in operation from around 1889 through 1967. The bulk of the mining was performed between 1900 and 1940, primarily utilizing the room-and-pillar method of mining. This method creates rooms from which the coal is mined, leaving only pillars to support the overburden. During second or retreat mining, most of the pillars are removed, allowing the overburden to collapse under its own weight. The mining was confined almost exclusively to the Pittsburgh Coal seam, which was primarily mined for its exceptional value as a coking coal. The primary coal companies which operated mines in the Monastery Run Project area included the Benedictine Society, Westmoreland and Fayette Coal Company, Mount Pleasant Coke Company, Latrobe Coal Company and Mount Pleasant By-Product Coal Company.

The water in the mined out Pittsburgh Coal seam under the project area is hydrologically connected to a very large mine pool located in the Latrobe Syncline. The majority of the mine workings located throughout the syncline are flooded. Water infiltrating into the abandoned mine workings from groundwater floods the voids, due to the synclinal nature of the seam. The hydraulic head of the mine pool in the flooded coal seam is greater than the hydraulic head of the

overlying aquifer, creating upward pressure and subsequent flow of mine drainage into the groundwater table. This phenomenon is known as groundwater mounding. Groundwater mounding has caused the discharge of the mine drainage contaminated groundwater at the surface via fractures, open boreholes, and subsidence holes. These discharges allowed for the development of AMD fed wetlands along Fourmile Run following the cessation of mining.

Local efforts to address the AMD problems into Loyalhanna Creek were started in the early 1990's, with the formation of a group that eventually became known as the "Loyalhanna Creek Mine Drainage Coalition". This very active and dynamic group consisted of several local organizations, including the Westmoreland County Conservation District, the Loyalhanna Creek Watershed Association, the Katherine Mabis McKenna Foundation, many local businesses and individuals, and St. Vincent College, which owned much of the land where the AMD surfaced. The local groups were assisted by state agencies, including the DEP's Bureau of Abandoned Mine Reclamation (BAMR), the Bureau of Watershed Conservation, and the Greensburg District Mining Office. Federal agencies involved include the former Bureau of Mines (now under the Department of Energy), the Natural Resources Conservation Service (NRCS), and the Office of Surface Mining. The Coalition decided to take a "top down" approach to tackling the water quality problems in Loyalhanna Creek, meaning that the upstream discharges would be addressed first, with the focus moving downstream upon the successful abatement/treatment of the Monastery Run discharges.

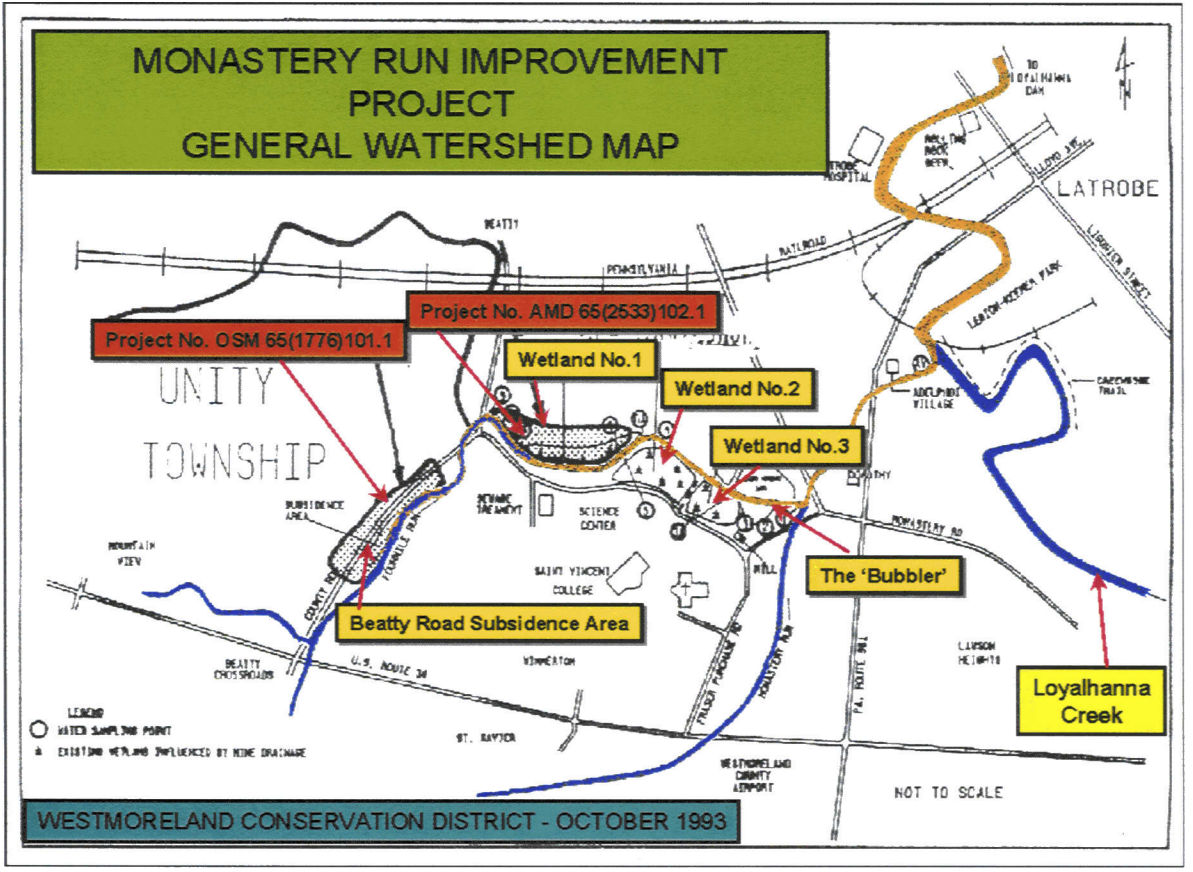
The Coalition formed two separate committees to keep momentum going in this effort. The Steering Committee provided the organizational support, kept the local citizens informed and involved, and looked for funding sources and other assistance in addressing the AMD problems. The Technical Needs Committee grappled with the complex technical issues involved in collecting and treating the AMD and evaluating impacts to the watershed. Three major funding sources eventually emerged: the NRCS, DEP's Bureau of Abandoned Mine Reclamation, and EPA's 319 Nonpoint Source Program, which is administered by DEP's Bureau of Watershed Conservation. The NRCS, using the P. L. 566 Watershed Protection Program, would provide 50% of construction funds for five project sites, while the two DEP agencies would provide 50% match. Private Foundations also contributed financial assistance.

The technical committee identified five primary project sites along Fourmile Run to address. The sites were identified as the Beatty Road Subsidence Area, Wetland No.1, Wetland No.2, Wetland No.3, and the 'bubbler'. As the project developed, the treatment of the discharge known as the 'bubbler' was incorporated into the wetland treatment systems identified as Wetland No.2 and Wetland No.3. The location of these project sites is identified on the, General Watershed Map included on the page of the nomination.

The "bubbler" mine drainage discharge.

Characterizing the Discharges and the Construction Sites

In some respects, the AMD problem in Monastery Run was relatively simple to address. The discharges were primarily alkaline, with iron being the only contaminant of any significance. This allowed for a much simpler design for the treatment of the discharges using passive facilities. In addition, four of the five project sites were on property owned by St. Vincent



College, whose staff and administration were very enthusiastic partners in this endeavor. These same four project sites had ample area available to construct passive treatment facilities.

However, there remained several complex technical issues to overcome. The area to be used for construction consisted of wetlands that had developed due to the discharge of AMD into low areas along Fourmile Run. The volume of some of the discharges fluctuated substantially during project planning. In particular, one of the discharges reached a high of 1850 gpm during high flow conditions, while this same discharge would stop flowing under low flow conditions. Treatment facilities needed to be designed to deal with these extremes. Another significant concern was capturing all the contaminated flow in the constructed facilities. Discharges surfaced as diffuse seeps in existing wetlands, and it was believed that base flow into Monastery Run was also contaminated. Also, one discharge had to be piped upslope to a treatment facility using the head on the artesian discharge to move the water. Careful analyses were needed to determine the feasibility of collecting the AMD and getting it to treatment facilities.

Flow monitoring and water quality analyses of all of the discharges were performed during 1995 and 1996. The data gathered during this period was utilized to determine treatment system design parameters. The discharges were determined to have a total iron content of between 70 and 100 mg/l. For Wetland #1, the design flow rate was determined to be 660 gpm. At average flows and iron loadings, the discharges to be treated carry 500-600 lbs/day of iron.

Description of Reclamation

A description of the reclamation activities for the Beatty Road Subsidence Control Project, the Wetland No.2 AMD treatment system, the Wetland No.3 AMD treatment system and the treatment of the "bubbler" is included on the project specific fact sheets included with this nomination.

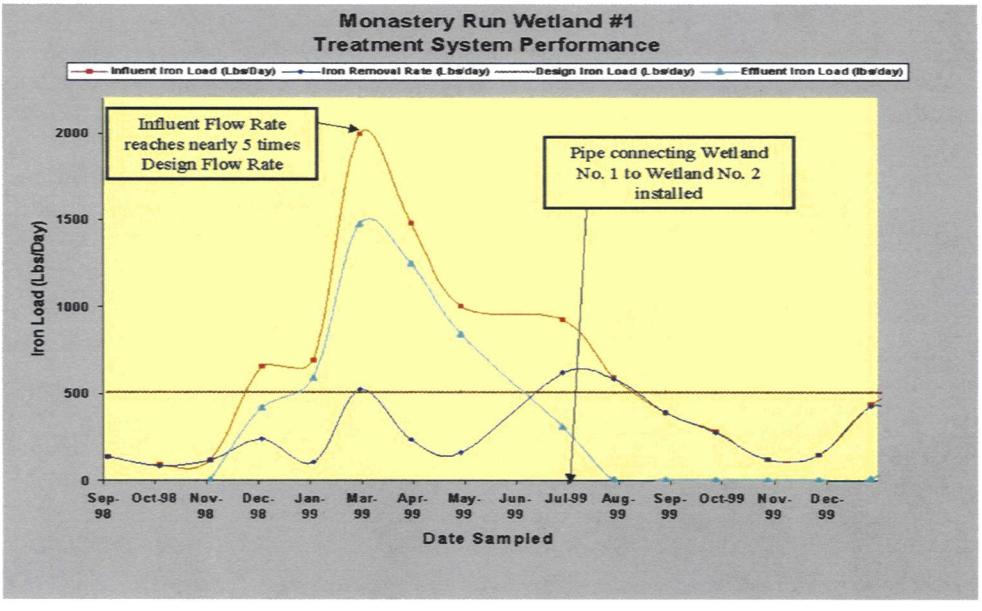
A description of the design procedure and reclamation activities for Wetland No.1, Project No. AMD 65(2533)102.1, will be outlined and discussed in the following paragraphs of the nomination. The techniques employed and the results achieved for this site closely parallel the

techniques, procedures and results for the other wetland treatment systems constructed as part of the Monastery Run Project.

Utilizing a model developed by the United States Bureau of Mines (USBM) and other wetland design references, a detailed design of a wetland treatment system for the Wetland No.1, Project No. AMD 65(2533)102.1, was developed. For net alkaline discharges, the USBM model recommends an aerobic wetland treatment system. Maximizing the available area within the project work area, four aerobic wetland treatment cells were laid out with a total wetland surface area of 9.1 acres. The USBM model recommended a minimum area of 7.5 acres for the flow and load conditions at this site. Major items of work required to construct the wetland treatment system include the construction of a permanent access road to the site, erosion and sedimentation control, clearing and grubbing, unclassified excavation of the wetland treatment cells, utility relocations, external embankment construction, internal dike construction, construction of flow control structures, placement of wetland substrate, slope protection, diversion and care of water, and revegetation of areas disturbed during construction of the project. The actual ground work consisted of excavating an existing wetlands created by the ten mine drainage discharges and replacing it with a man made wetlands capable of increasing retention time and aeration prior to discharge into Fourmile Run. The increased retention time was created using a series of cells, internal dike and wetlands plants to slow the flow. Aeration was achieved through the flow over the weirs between the cells.

Post Construction Results

Since the three wetland treatment systems were constructed, the systems have performed with extraordinary results. Some operational problems have come to light during the first year of operation of the facilities with the most serious problem being that significantly more AMD is entering the wetlands than the systems were designed to treat. This has primarily affected the initial performance of Wetland #1 and Wetland #2. For reasons unknown, in the spring of 1999, the influent flow rate in Wetland #1 reached nearly 3,500 gpm or five times the design flow rate. In order to provide for better treatment performance, Wetland #1 and Wetland #2 were connected together via an inverted siphon that carries the effluent from Wetland #1 under Fourmile Run and discharges it into Wetland #2. This has yielded amazing results, as the **discharge** from the outlet of Wetland #2 has consistently had a total iron concentration of **less than 1mg/l**. The three treatment systems combined are removing approximately 1,000 lbs. of iron each and every day, which is having a dramatic impact on the sediment loading from Monastery Run to the Loyalhanna Creek. This is readily apparent and can be visually identified on the before and after photographs of the confluence of the two streams that are included in this nomination.



Efficiency and Innovation

The four-celled wetlands that were designed and constructed required detailed monitoring of the quality, quantity, elevation, and location of the discharges within the project area. This information was critical in the design in order to maximize the retention time within the project and to reduce construction costs. Retention time is created using the series of four cells within the project area. Within each cell is a series of internal dikes that cause the water to flow in a serpentine pattern. The water flows in from one cell to the next via a concrete flow control structure. This structure contains movable stop logs that can be added or removed by raising or lowering the water level within the cell. The top stop log is equipped with a rectangular weir. The flow across each of these rectangular weirs between the cells allows for the necessary aeration. By using the four cells to lower the elevation of the water through a controlled stepping effect, the height of the external dikes could also be stepped. This simplistic gravity approach, rather than a series of pumps and mechanical devices, significantly reduced the overall construction cost.

Project Benefits

The benefits from this project are many, and some have been previously mentioned. This is a summary of the benefits and accomplishments of this project:

1. Significantly reduced iron discharge to Fourmile Run, Monastery Run, and Loyalhanna Creek. This is a boon for the aquatic life, fishermen, recreation, and the aesthetics of the streams. **(The three passive wetland treatment systems are removing approximately 1,000 lbs/day of iron from the AMD. This equates to over 180 tons per year of material which is not being deposited as orange, life-smothering precipitate in Loyalhanna Creek each year.)**
2. Created a controlled study laboratory for academia and St. Vincent College. The College conducts an annual Summer Institute in Watershed Restoration which studies the effects of the treatment systems and the recovery of the receiving streams. The College also holds an annual Monastery Run Project Symposium in November of each year to present research results and to update the local community on the success and progress of the project.
3. Proved the feasibility of a passive aerobic wetlands treatment system for future use.
4. The wetlands themselves are providing significant wildlife habitat, as ducks, geese and muskrats are extensively using the constructed wetlands.
5. Demonstrated what can be accomplished using the team approach.
6. Wetlands are being used to research 'resource recovery' for the iron oxide contained within the sludge deposited in the treatment systems.
7. The Latrobe High School has gotten students involved in monitoring this and other nearby watersheds.
8. The Loyalhanna Lake, a US Army Corps of Engineers dam, has shown an improvement in water quality, and, as a result, the USACOE is studying Saxman Run, the next AMD impacted stream downstream of Monastery Run.
9. This project site was showcased in two field trips during the 1999 National Association of AML Programs annual conference held at Seven Springs, PA in August of 1999.
10. Most importantly, the Monastery Run Project developed a working model for future comprehensive watershed organizations to pattern themselves after.

This project showed the dramatic success that can be obtained by forming a public-private partnership between local, state, and federal agencies, local educational institutions, and other local organizations and individuals. The success of the project using this approach has provided a model to be used in future watershed restoration efforts both within the Commonwealth of Pennsylvania and the rest of the nation.