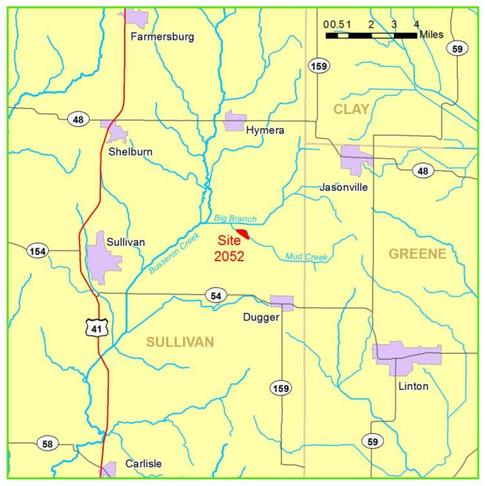
Indiana Department of Natural Resources
Division of Reclamation, Abandoned Mine Lands Section

Site 2052, Minnehaha Slurry

Location

Sullivan County, IN



A Dangerous Situation

This project addressed the urgent environmental and safety risks posed by a weakened levee holding back an abandoned slurry pond. The impoundment was directly adjacent to Mud Creek, which was relocated by a mining company in the mid-1900s to construct the tailings pond. The structural integrity of the levee was inadequate due to poor construction, and complete failure was a possibility.

The slurry pond covered over 60 acres.

Acid mine drainage from gob and slurry impaired water quality in Mud Creek, entering the creek through numerous seep zones along the levee. Highly acidic water constantly penetrating the levee further undermined its stability and threatened to breach the retaining structure.

Coal refuse in the levee allowed numerous acid seeps to penetrate, undermining its structural integrity.

An Innovative Design

The project goals were three-fold: repair the levee, reclaim the coal refuse, and remediate the acid mine drainage. AML engineers pushed the limits of landform design by proposing to stack the slurry from one side of the tailings pond onto the other. This excavation facilitated levee repair and also provided space to construct a large sulfate-reducing bioreactor.

The reclaimed slurry now forms gentle, rolling hills with a meandering stream.

Geomorphic design principles were used to create variable topography and minimize the potential for erosion gullies. Natural stream design techniques were also utilized to create a sinuous waterway through the new landscape.

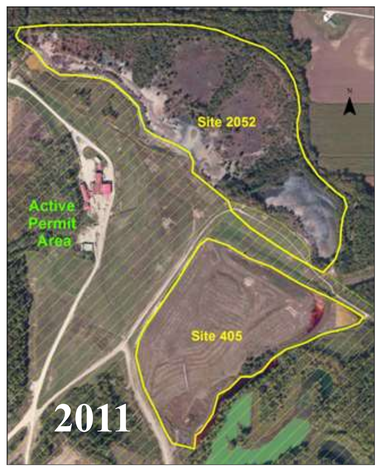
A Lasting Impact

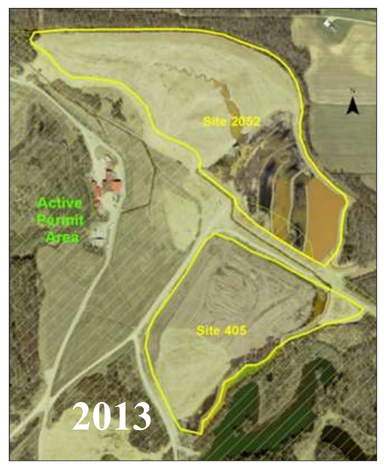
A passive treatment bioreactor was constructed to provide continuous remediation of acid mine drainage. Sulfate-reducing bacteria metabolize organic material in the bioreactor, which reduces acidity and causes metal precipitation. Compost provided the sulfate-reducing bacteria in the mixture and hay, straw, and wood chips supplied the organic material. The total volume of substrate used was 72,400 cubic yards.

The riprap-lined ditch conveys acid water from outside the site into the bioreactor.

The bioreactor takes in water from the stream draining the capped slurry and also from a reclaimed gob pile to the south. While water draining from the gob pile has a pH of 2.8, the bioreactor outfall has a pH of 7.6. With increased pH, concentrations of iron and manganese are reduced significantly.

These aerial photos show Site 2052 before and after construction. The capped slurry is in the northwest and the bioreactor is in the southeast. Site 405 is a reclaimed gob pile that now drains into the bioreactor.





Indiana contractor Aigner Construction, whose bid was 35% lower than its competitors, completed the work for $6.6 million. A project of this scale would not have been possible without the dedicated funding source provided by the Surface Mining Control and Reclamation Act.

A graduate student records flow data at a weir feeding into the bioreactor.

Both the geomorphic slurry landform design and the bioreactor function are being studied by scientists and students from the Indiana Geological Survey. Bioreactor construction is a developing methodology, and analysis of the Minnehaha system will enhance our understanding of this complex and state-of-the-art technology.

Project Highlights

- 595,500 cubic yards of slurry buried
- 212,600 cubic yards of gob buried
- 1,000 feet of levee stabilized
- 28,900 tons of bioreactor substrate used
- improvement in pH from 2.8 to 7.6

Hay and straw for the bioreactor formed impressive stacks.