The USGS Abandoned Mine Lands Initiative
Protecting and Restoring the Environment Near Abandoned Mine Lands

The Abandoned Mine Lands Initiative is part of a larger strategy of the U.S. Department of the Interior and the U.S. Department of Agriculture to clean up Federal lands contaminated by abandoned mines.
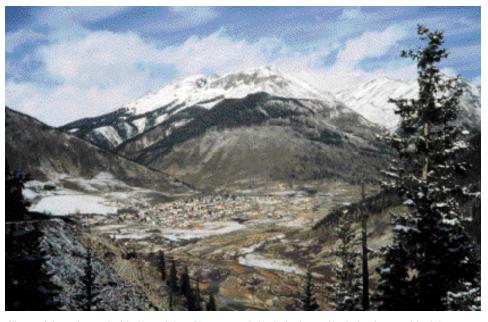
Thousands of abandoned hard-rock metal mines (such as gold, copper, lead, and zinc) have left a dual legacy across the Western United States. They reflect the historic development of the West, yet at the same time represent a possible threat to human health and local ecosystems.

Silverton Colo., at the mouth of the Upper Animas River, surrounded in the background by the headwaters of the Animas watershed where over 1,500 abandoned mines may be affecting downstream water and ecosystem quality.

Abandoned Mine Lands (AML) are areas adjacent to or affected by abandoned mines. AML's often contain unmined mineral deposits, mine dumps (the ore and rock removed to get to the ore deposits), and tailings (the material left over

Tailings filling the High Ore Creek valley, Boulder River watershed southwestern Montana in 1997. The creek eroded a channel through the tailings, washing them down to the Boulder River and enriching the water with metals.

from the ore processing) that contaminate the surrounding watershed and ecosystem. **For example, streams near AML's can contain metals and (or) be so acidic that fish and aquatic insects cannot live in them**.

Many of these abandoned hard-rock mines are located on or adjacent to public lands administered by the Bureau of Land Management, National Park Service, and U.S. Forest Service. These Federal land management agencies and the USGS are committed to mitigating the adverse effects that AML's can have on water quality and stream habitats.

The USGS AML Initiative began in 1997 and will continue through 2001 in two pilot watersheds - the Boulder

River basin in southwestern Montana and the upper Animas River basin in southwestern Colorado. The USGS is providing a wide range of scientific expertise to help land managers minimize and, where possible, eliminate the adverse environmental effects of AML's. USGS ecologists, geologists, water quality experts, hydrologists, geochemists, and mapping and digital data collection experts are collaborating to provide the scientific knowledge needed for an effective cleanup of AML's.

Goals of the USGS AML Initiative:

• Develop a watershed-based approach to provide scientific information needed for cost effective cleanup of AML's.

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- Determine the physical, biological and chemical processes that control the environmental effects of AML's.

- Provide scientific information for the design and implementation of AML cleanup methods.

- Transfer scientific methods developed in the two pilot watershed studies to other AML's nationwide.

- Demonstrate the ability of science to solve an important national environmental problem in a timely fashion.

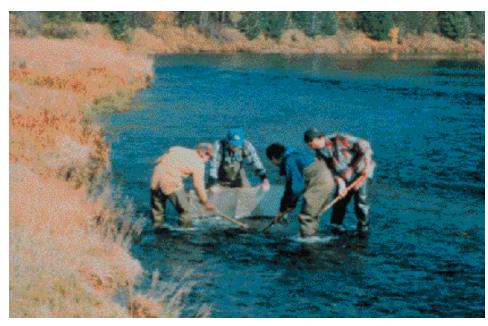- Develop effective working relationships with stakeholders, land management agencies, and regulatory agencies.

USGS Research Is Making A Difference

- Tracer tests, in which a harmless tracer, such as dye, is put into a stream and its downstream movement measured and modeled, are **successfully identifying the largest sources of AML contamination and enabling efficient targeting of cleanup activities.**

A natural spring in Prospect Gulch, upper Animas watershed in southwestern Colorado. Its red iron coloring and metals enrichment are caused by ground water coming in contact with naturally occurring minerals present as a result of ancient volcanic activity in the area.

- Measurements of water quality and quantity in both pilot watersheds have made possible the study of seasonal and other temporal variations in the movement of contaminants. **For example, these studies showed that**

Biologists collecting samples of aquatic insects from a site impacted by mining activity.

on approximately 354 days a year zinc levels in the upper Animas River exceeded the standards proposed by the Colorado Water Quality Control Division.

- Metal concentrations in fish and invertebrates in the two pilot watersheds were found to be higher than in the surrounding water and bottom sediments. **These measurements show that metals (some of which are toxic) are accumulating in the local food chain.** Researchers have also determined how these metals (such as cadmium, copper, lead, and zinc) move downstream to settle and accumulate in the bottom sediment of rivers and streams.

- In some cases, water quality near AML's was affected by the natural weathering of mineral deposits before mining occurred. Because of this, **scientists are working to determine the environmental conditions that existed before mining began in order to establish realistic cleanup goals for an area**.

- Mapping of the two pilot AML sites has identified those areas where land surfaces and stream channels have been affected by historic mining activities.

The Future of AML Initiative Research

USGS AML Initiative activities will conclude in the year 2001 with a summary of lessons learned for successful implementation of a watershed approach to characterize contamination from AML. Land managers will then be able to apply these lessons to remediate AML sites in other watersheds. One lesson already learned by the USGS is that the success of this initiative depends upon an interdisciplinary team of scientists working together with Federal land managers to provide science-based solutions to AML reclamation.

Information

For more information on Abandoned Mine Lands research at the USGS, please visit our Web sites at http://amli.usgs.gov/amli/ and http://www.usgs.gov.