Copper Basin Mining District Case Study

Use of Cooperative Agreements
Toward a Common Goal

- Approximately 95 million tons of ore have been processed in the mining district.
- EPA, Tennessee, and private companies are coordinating detailed investigations, communications, and cleanup efforts.
- A new wastewater treatment plant has removed approximately 6 million pounds of metals from the Davis Mill Creek in its first two years of operation.

The Copper Basin Mining District has been heavily scarred by mining activities and is currently an area in transition. Once considered the largest man-made biological desert in the nation, a 50-square mile tract of land was completely denuded following years of mining; farmers' crops were destroyed by sulfur dioxide gas emissions from mining wastes; and creek waters were so acidic that no life flourished. In the 1970s, a biological survey found only one living organism–an insect–in the waters downstream of the mining area. Today, EPA, private companies, and the State of Tennessee are working together to reforest the land, clean the polluted waters, and stabilize and contain mine wastes. On land that was once devoid of vegetation and clear waters, trees have taken root and aquatic life is gradually returning. Tourists and locals alike enjoy white water raft trips in the nearby Ocoee river, scenic train excursions, and visits to a historic mining museum. It is only through coordinated efforts by EPA, the State of Tennessee, and private companies–with much input from the surrounding communities—that this turnaround is possible. With continued coordination and the ongoing work by all parties, the future for this mining area looks promising.

July 2005

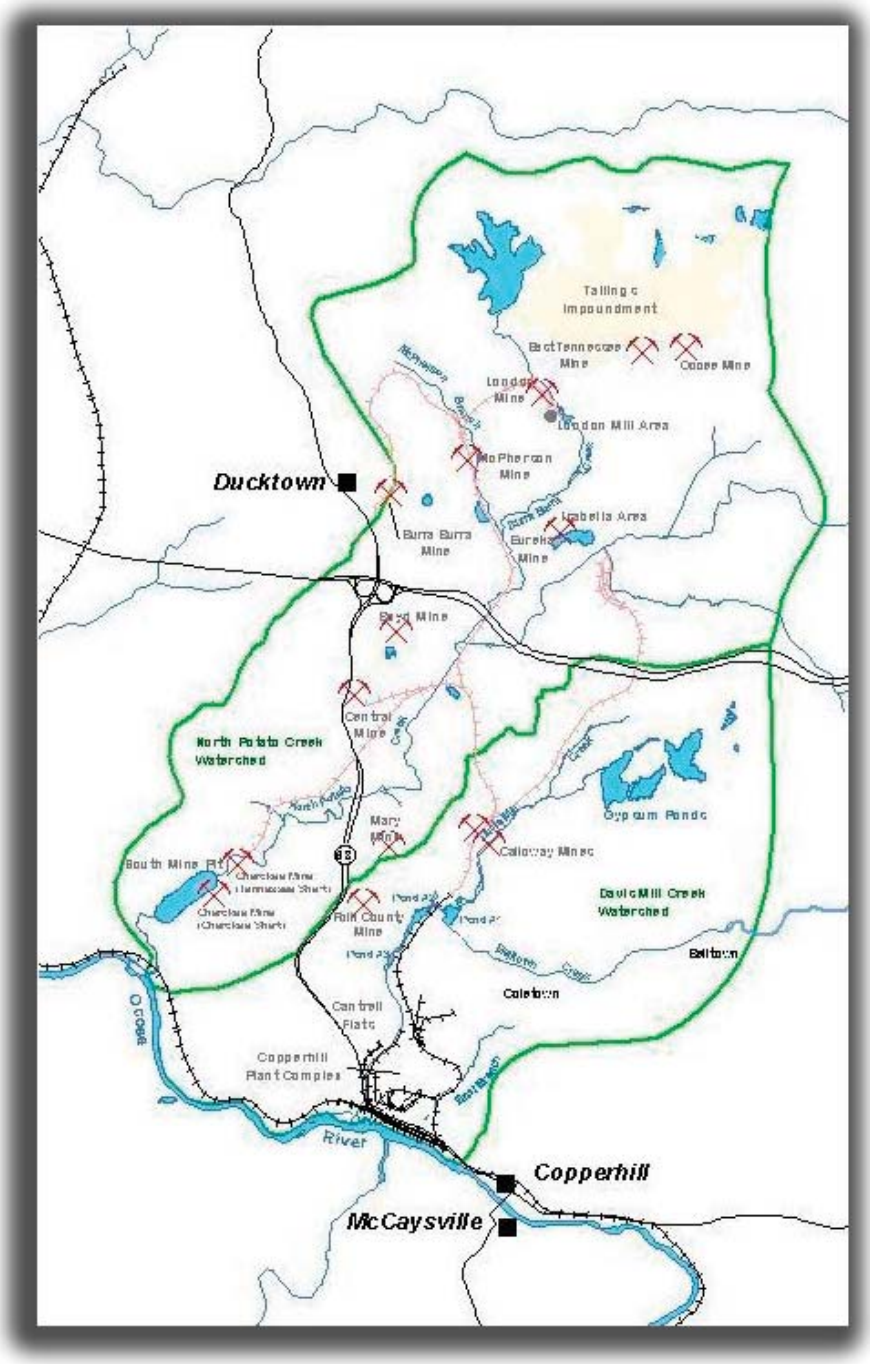
Site Location

Roughly 50 square miles in area, the Copper Basin Mining District site ("the site") is located in southeastern Tennessee in Polk County and northern Georgia in Fannin County, near the North Carolina border. The site includes contaminated segments of the Ocoee River system and two major watersheds: the 10,000-acre North Potato Creek watershed and the 3,000-acre Davis Mill Creek watershed. These creeks drain the Copper Basin area and discharge as tributaries into the Ocoee River. Contamination in North Potato Creek and Davis Mill Creek is attributed to multiple areas of mining waste in both watersheds.

History of the Copper Basin District

Copper was discovered in Ducktown, Tennessee in 1843. Over the next 150 years, mining and processing activities–centered on copper and sulfur–occurred throughout Copper Basin with brief interruptions. The total ore production of the site from nine ore bodies exceeded 95 million tons. The first large-scale environmental damages from the mining and manufacturing operations were described at the beginning of the 20th century.

Ownership and operation of the mines changed many times throughout its history. Some of the owners and operators since the late 1890s included, the Tennessee Copper Company (TCC), the Cities Services Company, and the Tennessee Chemical Company. OXY Oil and Gas USA, Inc. (OXY USA) became involved in the site as the corporate successor to Cities Services Company.



Copper Basin Mining District

Former diversion tunnel outfall in the Davis Mill Creek watershed

Mining Impacts

The mining and related processes produced solid wastes and byproduct materials that remain on site including sulfide-rich ore, sulfide bearing waste rock, tailings, granular and pot slag, iron calcine, magnetite, iron concentrate, wastewater treatment sludge, and demolition debris. Many of these materials are capable of, or are known to be, releasing acid or metals to the environment.

In addition, mining and related activities resulted in metals and polychlorinated biphenyls (PCBs) contamination, deforestation, and severe erosion. By the early 1900s, the area surrounding the site was deforested to provide fuel for the roasting of ore. The ore roasters, in turn, generated sulfur dioxide gas that killed any remaining vegetation and left the area denuded. Visitors to the

area in the early 1900s would have seen a vast area–approximately 50-square miles–stripped of all vegetation. Without the plants to protect the land, massive amounts of soil eroded, partially filling the stream beds and two reservoirs on the Ocoee River.

The release of sulfur dioxide gas not only harmed native flora but also severely damaged local crops and endangered the livelihood of area farmers. In 1907, farmers in Georgia sued the owners of the site for nuisance conditions. To resolve the situation, the company reduced emissions by using sulfur gases from copper furnaces to produce sulfuric acid. It wasn't until the 1980s that the area was successfully reforested.

Isabella mine collapse

Both the Davis Mill Creek and the Lower North Potato Creek contribute acid, heavy metals, and sediment to the Ocoee River. The Davis Mill Creek watershed contains more than 15 million tons of mining-related waste materials and is devoid of aquatic life. The physical appearance of the streams has also changed, with large portions being redirected due to mining operations. The Davis Mill Creek now meanders around and through waste piles, picking up additional contamination as it flows toward the Ocoee River. Although Davis Mill Creek contributes approximately one percent of the water in the Ocoee River, it is the largest single source of acidity and heavy metals. The pH of the creek water ranges from 2.5 to 3.5. Brightly colored colloidal iron precipitates coat the stream bed and quickly cover any organism or organic matter that enters the stream.

Contaminated sediments impact the Ocoee River adjacent to the mining operations and continue approximately 25 miles downstream of the site. The Ocoee River is listed under Section (303)d of the Clean Water Act.

Investigation for the National Priorities List (NPL)

Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), more commonly known as Superfund, EPA has the authority to pursue long-term remedial response actions that permanently and significantly reduce the dangers associated with releases or threats of releases of hazardous substances. When using Superfund monies, however, these actions can be conducted at only those sites listed on EPA's National Priorities List (NPL). In order to address the large-scale contamination at the site, EPA investigated placing Copper Basin Mining District on the NPL. Although the site could have been addressed through listing on the NPL, an alternative solution was proposed: cleaning up the site through enforceable legal agreements.

Photograph of leaf taken from the streambed of Davis Mill Creek just upstream of the Calloway Mine. The leaf and the streambed in the background are coated with iron hydroxide that has precipitated out of the water in response to changes in pH.

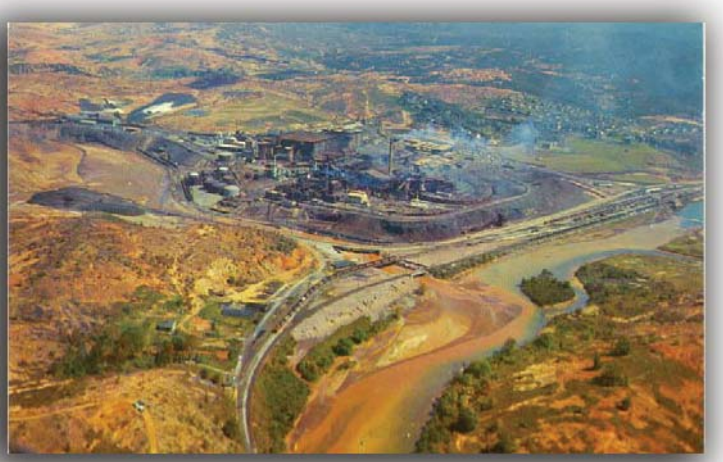
History of Cooperative Agreements

Under legal agreements dating from 1990, various government agencies and private parties have taken steps to stabilize and partially revegetate the area. In 1990, an agreement among Boliden Intertrade, EPA, and the State of Tennessee was finalized. The following year, EPA and OXY USA entered into an Administrative Order on Consent (AOC).

The site is currently being investigated and cleaned up through a collaborative three party effort that was formalized on January 11, 2001 in a Memorandum of Understanding (MOU) and several related legal agreements among EPA, the Tennessee Department of Environment and Conservation (TDEC), and OXY USA. The MOU provides an overall framework and establishes roles and responsibilities among the three parties for the

investigation and cleanup work. It also provides assurance on the part of the federal government not to list or propose to list the site on the NPL as long as terms of the MOU are met. The enforceable agreements add details about the legally binding commitments made between OXY USA and the government.

Through the agreements and the cooperation of the partners (TDEC, EPA, and OXY USA), various agencies and programs will be able to lead and participate in the cleanup actions based on the strengths of the particular agencies and programs involved. Currently, Glenn Springs Holdings, Inc. (GSHI), a wholly owned subsidiary of OXY USA, conducts its share of the cleanup actions with oversight from TDEC and EPA.



Work Status Overview

The legal agreements created the framework for cooperative remediation and site treatment activities that have been funded by GSHI. As part of these remediation efforts, GSHI has conducted extensive studies and prepared reports and work

Table 1: Davis Mill Creek & North Potato Creek Actions Summary

Area	Order	Purpose	Action	Status	Results
Davis Mill Creek Watershed	EPA Order–Removal Action	To create the Davis Mill Creek Existing and Committed Water Treatment System to detain and treat contaminated water and bypass the clean waters of a 10-year 24-hour storm event	GSHI refurbished the Cantrell Flats Wastewater Treatment Plant to treat acid and metal laden waters of the creek, underground mine waters, and contaminated storm water.	Complete	From November 2002 to November 2004, the plant treated 1.9 billion gallons of contaminated water, removed 5,975,806 pounds of iron, zinc, manganese, copper, lead, and cadmium and neutralized 13,935,382 pounds of acid.
			GSHI installed the Belltown Creek and the Gypsum Pond Creek diversion systems.	Complete	Routes clean water around the most contaminated parts of the watershed and reduces the volume of water requiring treatment.
			GSHI upgraded and modified the three existing dams in the watershed.	Complete	Detains contaminated storm water for treatment.
North Potato Creek Watershed	EPA Order–Removal Action	To temporarily alleviate the contaminant discharge while long-term actions under the state VCP proceed	GSHI installed lime treatment plant near the mouth of creek at the South Mine Pit.	Complete	Removes 90 percent of the dissolved metals of ecological concern and raises pH of the discharge from 3.3 to 7.0.
	State Voluntary Cleanup	To provide for long-term protection of human health and the environment	GSHI is evaluating areas potentially affected by past mining and will develop cleanup alternatives.	Ongoing	Ultimately establish biological integrity in the watershed.

Surface impoundment for Cantrell Flats Wastewater Treatment Plant

plans that have been approved by TDEC and EPA. Agreements and removal actions are frequently amended as site activities progress to ensure the most efficient site cleanup. GSHI, EPA, and TDEC have undertaken both major and minor actions to clean the Copper Basin area.

GSHI has implemented a series of EPA removal orders in the Davis Mill Creek watershed and has established the Davis Mill Creek Existing and Committed Water Treatment system. EPA required short-term actions in the North Potato Creek watershed to temporarily alleviate the contaminant discharge of North Potato Creek to the Ocoee River while long-term actions under the State Voluntary Cleanup Program (VCP) proceed. A summary of these Davis Mill Creek and North Potato Creek actions is found in Table 1.

In addition to the actions outlined in Table 1, a TDEC Commissioners Order for North Potato Creek Watershed established biological integrity of the watershed as its long-term goal and requires shorter, interim remedial actions to protect the health and safety of the public and the environment. GSHI has completed or is in the process of completing these actions. These include capping the lead contaminated soil at the site of the former Isabella chamber acid plant and covering and revegetating the abandoned slag dump also at Isabella. The 300-acre tailings pond was revegetated with native grasses and over 86,000 trees. PCB contaminated equipment and soils were removed from ten different areas across the watershed. Over five miles of 8-foot tall, barbed wire topped chain link fencing and subsidence monitoring equipment have been installed around seven different areas of abandoned and collapsing mine works. Additions and modifications to the experimental passive wetlands system have been completed. A comprehensive inventory of acid generating materials and hazardous substances associated with historic mining in the watershed has been conducted.

These actions illustrate how all parties are working to address waste from historical mining activities. Although work remains to be done in Copper Basin, cooperatively planning and conducting cleanup activities will help reduce current and future impacts to human health and the environment.

Community Involvement

Site partners have made extensive efforts to encourage community participation and involvement in the remediation activities at the site. The legal agreements include a commitment from the parties to involve the community throughout the remediation process. Using the legal agreements as a starting point, site partners have incorporated additional opportunities for public participation.

- The State of Tennessee operates the Burra Burra Historic Mine Site Ducktown Basin Museum, which is a record of the basin's history, mining technology, and the heritage of the Cherokee Nation.
- GSHI and its parent company OXY USA, in coordination with EPA and the State of Tennessee, keep the local press informed by periodically taking them on site tours.
- On July 4th each year ("Miners Day"), there are public tours of the site along with an open house hosted by GSHI.
- On Earth Day, there are tours and activities in Copper Basin for local students and groups. In the past, Boy Scout groups and high school students have helped create silt fences and plant trees at the site.

London Mill Flotation Plant ruins

The partnership held a series of interviews and meetings in 2001 with local officials, community members, and other interested parties to determine the questions and concerns that the community had about the site. Using information gathered from these interviews and meetings, the partnership developed a Community Involvement Plan. In spring 2002, GSHI provided $50,000 to fund a Technical Assistance Program to provide technical expertise to help the community participate in the remediation process. In 2005, GSHI provided an additional $50,000 grant to the community. The partnership developed and implemented a site education program to keep the community informed about site activities. As part of this program, the partnership developed a video featuring mining history, environmental effects of the mining, and remediation activities.

Historic photo of deforestation in North Potato Creek Watershed

Early Pioneer of the Superfund Alternative Approach

In 2002, EPA issued guidance on response and settlement strategies for sites that are eligible but have not been listed on the NPL. EPA revised this guidance in June 2004. It outlines the steps EPA Regions should take to ensure that the settlements and cleanups at such Superfund Alternative (SA) sites are equivalent to settlements and cleanups at sites listed on the NPL. Many of the same methods to foster effective collaboration while ensuring consistent and adequate cleanup were and are still being used at the Copper Basin Mining District site, making it an excellent example of the use of the Superfund Alternative approach in many ways.

Cooperation Among Parties Toward a Common Goal

The innovative multiparty agreements ensure that TDEC, GSHI, and EPA work together in a coordinated manner with the common goal of environmental remediation and redevelopment of the Copper Basin Mining District. In addition, the agreements ensure that the partners actively coordinate public participation activities and free-flow communication, which provides a benefit to all parties. Timely cleanup will help ensure the community's continuing economic growth as natural resources are protected, as illustrated by the protection of the Ocoee River white water rafting industry. All parties cooperate to apply and shift resources where they can optimally benefit the site. The approach encourages long-term stewardship of the site by GSHI and avoids prolonged litigation that could delay site cleanup and spend funds that could otherwise be used for cleanup efforts.

Tree seedlings on the tailings pile (circa 2004)

The cooperative and collaborative approach is maintained between the site partners through technical progress meetings that encourage coordination and allow for accelerated decisions about site activities. The following agencies are typically represented at the meetings: TDEC, TDEC Division of Water Pollution Control, TDEC Division of Superfund, EPA Superfund, EPA Site Remedial Project Managers (RPMs), GSHI, U.S. Army Corps of Engineers (USACE), Tennessee Valley Authority (TVA), and contractors.

Site Reuse and Economic Development

All partners kept an end goal in mind while planning site activities: to successfully clean the site in a way that allows future reuse of the land and waters. As such, when addressing the tailings pond, GSHI planted grass and trees, keeping in mind the final reuse goal to create habitat suitable for wildlife.

Some reuse strategies at the site also foster economic development in the surrounding community. For instance, the source control efforts of the Davis Mill Creek and North Potato Creek have improved the water quality of the Ocoee River and have allowed a white water tourist industry to thrive. Other mining sites could benefit by similarly incorporating reuse goals in initial cleanup planning.

Limitations of the Approach

The MOU and State Voluntary Cleanup program were highly successful at this site, based largely on the willingness and ability of the site partners to work cooperatively for the benefit of the site. GSHI has a long-standing reputation for responsible environmental stewardship and was willing to collaborate with EPA and TDEC. This approach would not be appropriate for sites with unwilling or unable potentially responsible parties (PRPs).

Lessons Learned and Conclusion

Successful cooperation among the partners at this site has been facilitated by several key features of the remediation process that include the following:

- formation of a site partnership to deal collectively with a large, complex site;
- a highly collaborative remediation process with all parties involved at the site providing input at the technical meetings;
- multiple party review and input into work plans;
- dynamic work plans that are revised, when appropriate, due to new sampling or fieldwork information;
- completion levels that are based on established performance goals, encouraging thorough workmanship; and
- public participation.

The MOU and legal agreements promoted strong collaborative relationships among the partners, resulting in numerous environmental studies, sampling events, and cleanup actions, all with the common goal of reducing the impact of 150 years of mining activities. In an area rich with natural resources and a long history of mining, the agreements provided a framework that allowed the partners to work simultaneously on multiple areas of complex contamination with metals and acid-producing materials. Innovative projects, such as recruiting help from community groups for planting trees and building silt fences, and providing tours of the site to local schools and citizen groups, encouraged active public participation. The remediation process for the Copper Basin Mining District site could be applied as a national model for abandoned mine land cleanup, but the system requires consistent and diligent work by all parties involved.

North Potato Creek Area Cleanup Milestones

January 4, 2001	OXY USA and TDEC signed Voluntary Cleanup and Oversight Assistance Program for North Potato Creek.
July 2001	EPA approved GSHI work plan for Engineering Evaluation/Cost Analysis (EE/CA) for North Potato Creek.
October 2001	PCB-contaminated devices removed from North Potato Creek area.
March 31, 2003	Action memorandum signed to implement the selected alternative for North Potato Creek.
Spring 2003	GSHI installed approximately five miles of fences to restrict access to potentially unsafe areas near Lower North Potato Creek.
January 10, 2005	Lime treatment plant on North Potato Creek began operation.

Davis Mill Creek Area Cleanup Milestones

June 21, 2001	GSHI completed work plan for diversion of Belltown Creek and Gypsum Pond and work plan for refurbishment of Cantrell Flats Wastewater Treatment Plan.
Fall 2001	EPA completed fieldwork for sampling for Lower Davis Mill Creek area.
November 2002	Cantrell Flats Wastewater Treatment System became active.
August 11, 2003	Additional AOC signed to amend the original removal action for Davis Mill Creek.
2004	Belltown Creek and Gypsum Pond Creek diversion systems installed and active.