



## EMERGENCY MINE AND STREAM CHANNEL RESTORATION

GAMBONINI MERCURY MINE SUPERFUND SITE  
MARIN COUNTY, CALIFORNIA

### PROJECT DESCRIPTION

During the mid 1960's, cinnabar (mercury ore) was mined from an open-pit at this site in Marin County. Mercury-contaminated tailings and other mine waste were deposited on steep slopes adjacent to the mine pit. Since mine closure in the early 1970's, the mine waste deposit had suffered a deep-seated slope failure and severe erosion by storm water runoff resulting in the discharge of mercury-contaminated sediment into local streams with ultimate deposition into Tomales Bay where oysters are harvested. Faced with an environmental hazard, the California Regional Water Quality Control Board (RWQCB) and the Federal Environmental Protection Agency (EPA) classified the Gambonini Mine as a Superfund site and initiated emergency cleanup efforts. The primary goal of the cleanup plan was to reduce toxic sediment discharge from the primary mine waste deposit.



### ENGINEERING SOLUTION

The EPA and RWQCB retained Cotton, Shires and Associates, Inc. (CSA) to characterize the erosion and slope stability problems, and to develop conceptual plans for reducing the toxic sediment discharge. CSA performed a geotechnical investigation that included analysis of aerial photographs, detailed geologic mapping, and subsurface exploration. This investigation discovered that the primary mine waste deposit had been deposited on top of a pre-existing bedrock landslide. Mitigation alternatives to stabilize the mine waste and the landslide were developed to provide an extensive surface drainage network, and thereby reduce sediment discharge off the site. The mitigation alternative selected by the EPA and RWQCB included a large gravity buttress along the lower half of the mine waste slope. Restoration of the 12-acre mine waste deposit began immediately and the mass grading was completed in three months. CSA provided full-time field engineering services for the General Contractor, CET Environmental Services, Inc., of Seattle, Washington. Approximately 213,000 cubic yards of earth materials were removed from the upper reaches of the slope, thus reducing the surcharge on the unstable mine waste deposit and the underlying bedrock landslide. The gravity buttress covers approximately 3.5 acres, was constructed with approximately 146,000 cubic yards of engineered fill, and has a maximum thickness of about 50 feet. Approximately 2,600 lineal feet of subdrains were constructed along pre-existing drainage paths and as backdrains within the gravity buttress. The surface drainage system incorporates drainage swales, V-ditches, drop inlets, and buried storm drain pipelines. These elements convey all runoff away from the mine waste deposit and into the stream channel reconstructed with rip-rap and planted with willow wattles. Revegetation of the site is being coordinated by the RWQCB and should result in a natural looking landscape over the next several years.