



# FEMA

## Historic Bisbee Completes Multiple Mitigation Projects for Flood Protection

**Bisbee, AZ** - With the help of several Community Development Block Grants and FEMA's Hazard Mitigation Grant Program (HMGP) Bisbee upgraded its stormwater management infrastructure throughout the city after years of damaging flooding problems. Bisbee's normal annual rainfall is 12 1/2 - 13 1/2 inches per year with most of it falling during the month of September. Rainwater falling on the Bisbee side of the Mule Mountains drains through Mule Gulch, right through downtown Bisbee - through flumes, ditches, culverts and box channels, then out into the old Lavender Pit copper mine south of town.

In 1906 Bisbee suffered from both a catastrophic fire and flood. After that flood, the city constructed a box channel to direct water under streets and buildings, but made the opening at the lower end of the main box channel smaller than the opening at the upper end, causing backups and overflows.

To eliminate this problem, the city applied Hazard Mitigation Grant Program (HMGP) funds to develop the Mule Gulch Drainage project from 2001 to 2003, increasing the size of the box channel as well as the downstream opening.

Bisbee also used HMGP funds to complete the High Road Retaining Wall project. The original wall was rotating away from the road it supported. Rather than use standard soil nails to anchor the concrete wall to the side of the hill, engineers opted for using E-bow anchors.

Not only were the E-bow anchors more effective, they offered a 40% cost savings over soil nails. The engineers attached the anchors to a wire grid, and then sprayed shotcrete (Mortar or concrete conveyed through a hose and projected pneumatically at high velocity onto a surface; shotcrete can be dry-mix (gunite), or wet-mix) onto the grid. This project protected both the road and access for 60 homes above it.

In total, this series of HMGP projects replaced 17 miles of 100-year-old redwood sewer pipe, strengthened retaining walls, and renovated the storm drainage system to carry more runoff. In 2006, the improvements were tested when storms brought rains totaling 22 inches. One storm alone dumped five inches of rain on Brewery Gulch in a 24-hour period. The particularly rainy season caused no flooding in the city, due to the improved drainage system.



Cochise County, Arizona



### Quick Facts

Year:  
**1993**

Sector:  
**Public**

Cost:  
**\$787,390.00 (Actual)**

Primary Activity/Project:  
**Flood Control**

Primary Funding:  
**Environmental/Historical Preservation**