PROJECT BACKGROUND
Constant demands for water and electricity in heavily populated areas in California prompted the Devil Canyon Power Plant project. Constructed from 1969 to 1974, the power plant is located at the San Bernardino Mountains near the mouth of Devil Canyon. Two pipelines, carrying water from Silverwood Lake and through an elevation drop of 1500 ft (460 m) and four Pelton wheel turbines, generate enough power to accommodate both the communities of San Bernardino and Riverside.

PROJECT CHALLENGES
Severe erosion. Difficult site access. Time constraints.
In 1994, the pipelines were in trouble. Erosion of the structures built to support the pipelines due to decades of water runoff was noticed. Winter was just around the corner and engineers looked for a solution before further erosion threatened the pipelines.

“Our greatest challenge was access in and around the pipeline,” explained Ron Lee, Project Engineer for the State of California’s Department of Water Resources. He continued, “As the pipeline travels down the mountain, it covers some very steep sections. The grade goes from flat to nearly 45%. Several sections are easily accessible with vehicles, while others on the steepest portions are only reachable on foot.”

The project needed to be completed within 30 to 40 days, before harsh winter rains set in. Return trips would make the project costly and time consuming so finding a long-term solution was even more critical.
**FLEXIBLE FORMWORK | HARD-ARMOR PROTECTION**

Conforms to grade contours. Controls concrete thickness.

The GEOWEB System eliminated the need to build forms and the cellular structure provided a permanent flexible form acting as a series of expansion joints adjusting to the shape and grade of the soil. The concrete thickness could be controlled due to the system’s uniform depth. The surface finish and thickness of the concrete were selected to meet the specific design needs.

Over 1800 ft² (170 m²) of the confinement system were installed. Folded like an accordion, the sections were brought up by trucks and placed in designated areas at the steepest parts of the mountains. In some cases, when an area was inaccessible, workers carried the sections and placed them where needed. The GEOWEB sections were expanded, staked in place and pumped with shotcrete for an installed strength of 3000 psi (21 MPa). The sections were then struck off and left to set up with no extra finish work needed. To help divert runoff, special check dams made of shotcrete were placed on the filled concrete surfaces. The dams diverted the runoff before water could accumulate and do any damage.

**PROJECT RESULTS**

Installation was completed in less than 40 days. Since its completion, the pipeline has survived various bouts of the El Niño weather pattern.